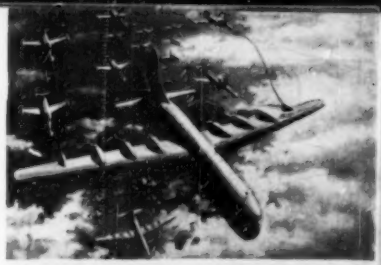
# POPULAR SCIENCE

Feb. 1950 25¢ Monthly



Sky Cow for Jets — page 114

**Big Mouth Eats a Ton a Second**

PAGE 100

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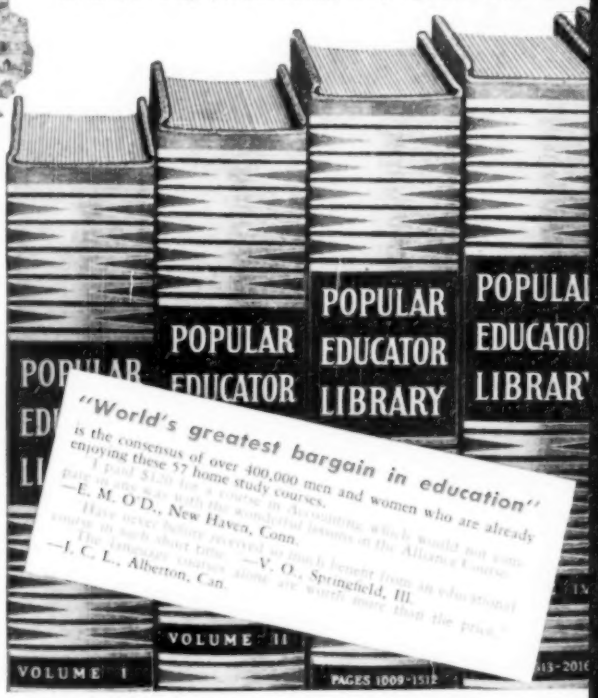


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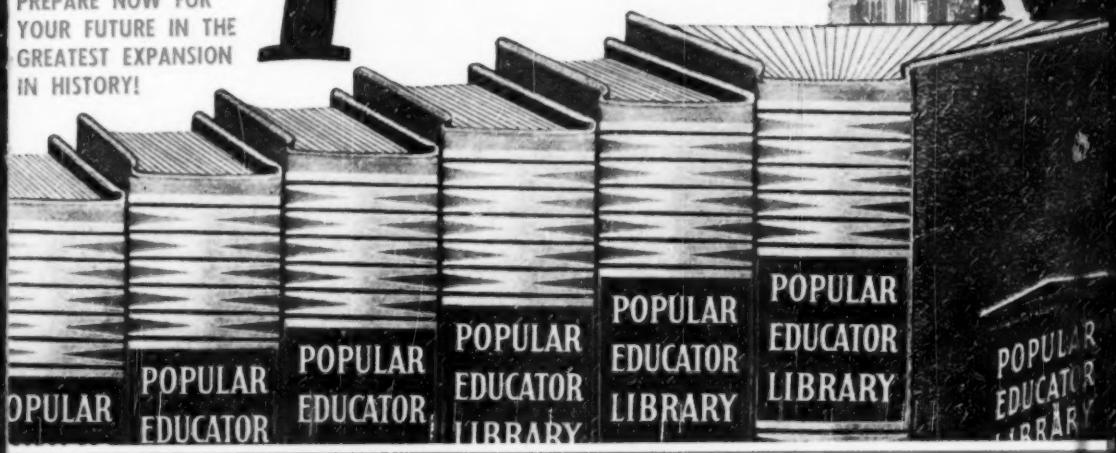


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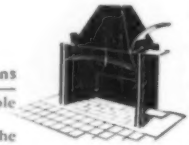

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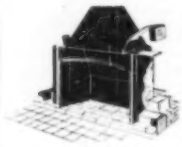

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IF YOU have or hope to have a metal-turning lathe, the story on page 206 is for you. It shows, in pictures, a whole series of basic lathe operations and how to set them up—boring, facing, turning, drilling, and even simple milling. By following the procedures explained, you can teach yourself machining fundamentals in your home shop.

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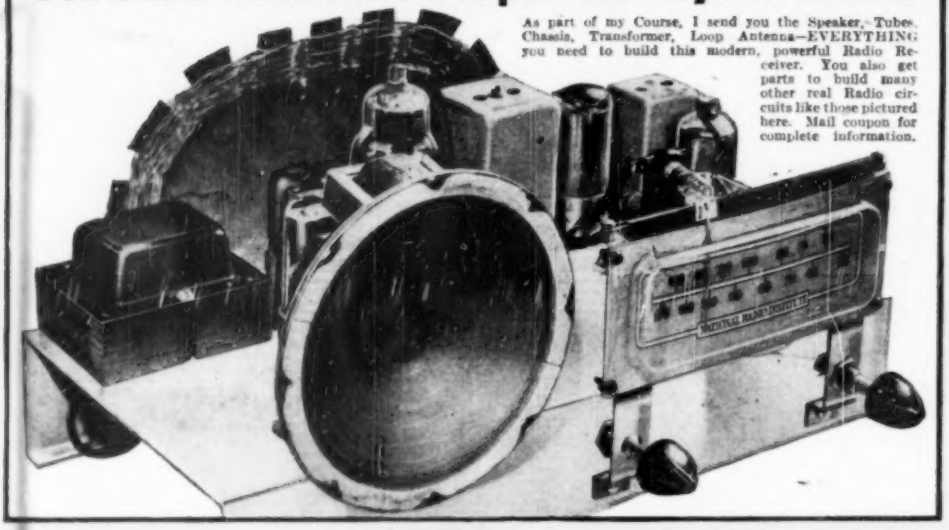
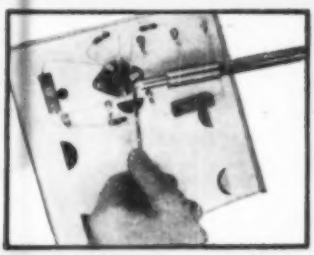
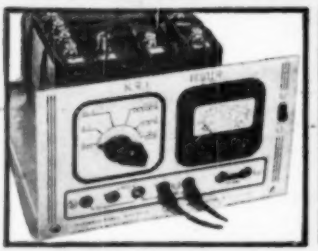
As part of my Course, I send you the Speaker, Tubes, Chassis, Transformer, Loop Antenna—EVERYTHING you need to build this modern, powerful Radio Receiver. You also get parts to build many other real Radio circuits like those pictured here. Mail coupon for complete information.

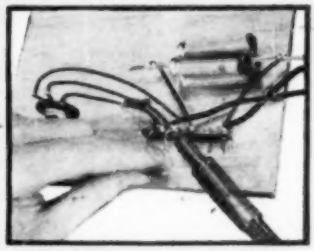




**YOU PRACTICE** Radio soldering with Soldering Equipment and Radio Parts I send you. Get practical experience mounting and connecting parts.



**YOU BUILD** this Tester with parts N. R. I. sends early in course. Soon helps you fix neighbors' Radios and EARN EXTRA MONEY in spare time.



**YOU TEST** Radio Circuits like this built with parts I send. Build special circuits; learn how to locate and repair circuit defects.

## MEN I TRAIN AT HOME GET GOOD JOBS LIKE THESE

**MADE $1500 WHILE LEARNING**

"By the time I finished my NRI training I had made $1500. When I started the Course I did not know a resistor from a condenser. I have bought my home. My income from Radio work, etc., is about $3,000 a year." — WILLIAM THOMAS, Baldwyn, Mississippi.

**ASSISTANT TO CHIEF ENGINEER AT STATION WHJB**

"Have been employed for the past two years as assistant to the chief engineer at Radio Station WHJB. Knew nothing about Radio when I enrolled for the NRI Course."—CECIL J. GIUNIPERO, Greensburg, Pennsylvania.

**KNEW NOTHING ABOUT RADIO**

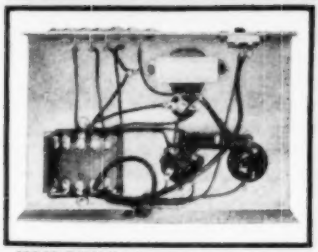
"I knew nothing about Radio when I enrolled. At present I am doing spare time work. I have more than paid for my Course and I have about $200 worth of equipment which has paid for itself." — RAYMOND HOLTCAMP, Vandalia, Illinois.

**FULL-TIME JOB BEFORE FINISHING COURSE**

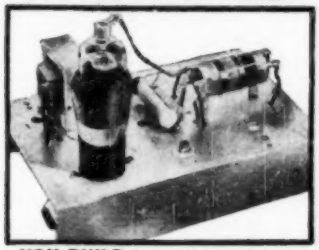
"After completing about two-thirds of my Course I entered a Radio Repair shop. Later I branched out for myself and opened a shop in my own home. I am much pleased with the work I had during my first year of business."—A. H. AYERS, Washington 16, D. C.

# by Practicing in Spare Time

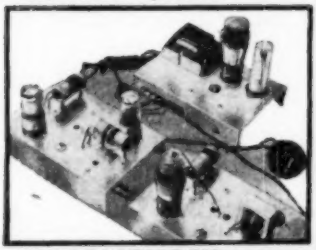
**I Send You Big Kits of Radio Parts**



**YOU BUILD** Vacuum Tube Power Pack; make changes which give you experience with packs of many kinds. Learn how to correct Power Pack troubles.



**YOU BUILD** this A. M. Signal Generator for more valuable experience. It provides amplitude-modulated signals for many tests and experiments.



**YOU PRACTICE FM** (Frequency Modulation) experiments, get more experience with this Superheterodyne Receiver Circuit you build with parts I send.

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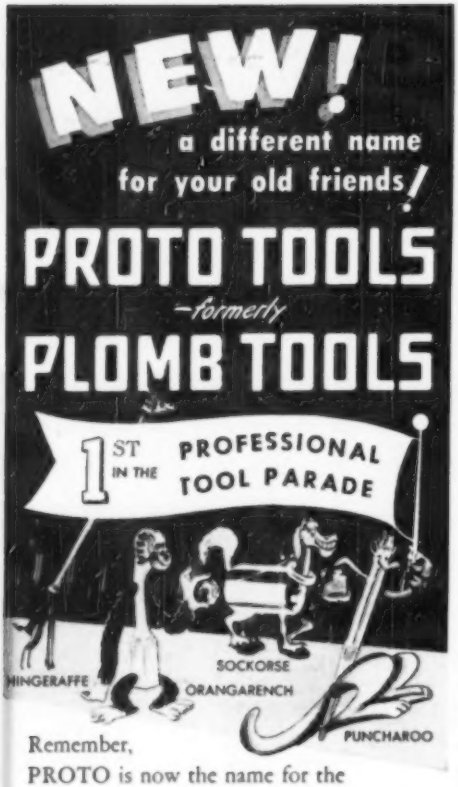


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# Letters

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NASH R. PALMER

Chicago, Ill.

Sir:

When a guy has a lot of your magazines stacked flat and wants to locate a particular article, it is quite a job to find it. To make this easier, I paint a good-sized serial number across one end or side of each issue and then keep an index of interesting articles by book number and page.

A. C. BROCKWAY

Huntsville, Ala.

### Carousal vs. Carrousel (cont.)

Sir:

I'd like to add my two-cents worth to the argument in your letters column (Nov., p. 18) about how to spell "carrousel" and whether it turns clockwise or backwards.

Perhaps reader Planitzer, with his preference for "carousal," is referring to what my dictionary defines as a "revelry or drinking bout accompanied by noisy jollity." Then he would be correct in assuming that it travels in a counterclockwise direction.

H. R. PARADISE

Seattle, Wash.

### Car With a History

Sir:

I was particularly interested in the article "Good Cars Never Die," on p. 183 of your November issue, on account of the author, Murrelle Mahoney, being a Duesenberg expert.

It might interest him, and you, to know that I have the original "Mormon Meteor"

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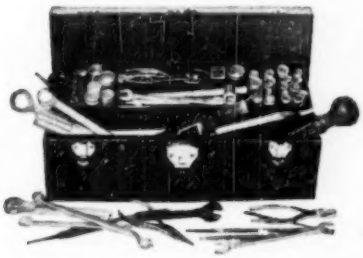

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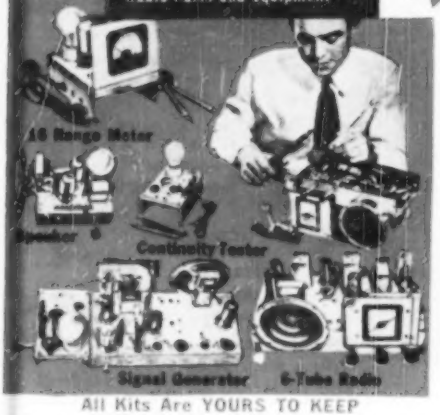


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Soon after you start training I send you my famous BUSINESS BUILDERS that show you how to make money in spare time doing interesting Radio jobs. I send you 8 big kits of Radio parts and equipment and help you build step-by-step a powerful 6-tube superhet radio, a 16-range test meter, plus other mighty useful equipment for Radio and Television servicing. You will perform over 175 fascinating experiments while training. You will learn about Television—so that you will be qualified to step into this fast growing, profitable field. I also send you many valuable service manuals, diagrams, and my book telling exactly how to set up your own Television and Radio shop. Clip and mail the coupon below for my two big FREE Radio books. I employ no salesmen—and nobody will call on you.

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A profitable Radio and Television Service Shop may be started with little capital. I will show you how to get started. At left is pictured one of my graduates, Mr. Merrit C. Sperry, Fairmont, Minn. in his own shop.

## All Kits Are YOURS TO KEEP

Each of the hundreds of Radio parts and other items I send my students is theirs "for keeps." You may use this equipment in your Radio and Television service work and save many dollars by not having to buy expensive "ready-made" test equipment.

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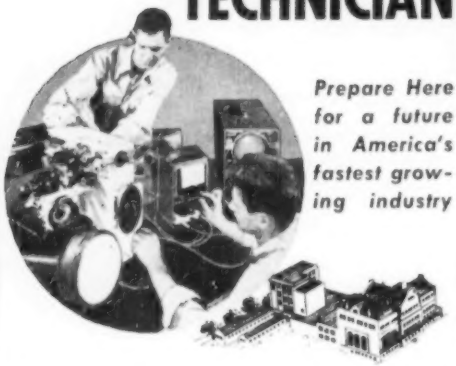

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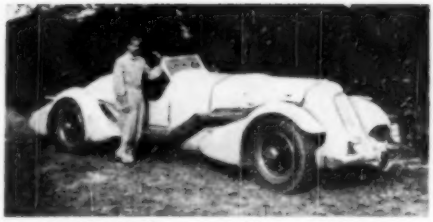

*Reader Hudson and Mormon Meteor*

that Ab Jenkins drove on the Bonneville Salt Flats to a world record of 135 m.p.h. for a 24-hour average on Aug. 31, 1935.

It's a Duesenberg SJ, a regular factory-produced model except for its special body. It was built at Indianapolis, and Augie Duesenberg personally was in charge of it during the endurance run.

This car was capable, at the time, of speeds over 170 m.p.h. on the straightaway. Jenkins's average over the first 300 miles was 152 m.p.h. His 24-hour record was later bettered by custom racing models but has never been approached for passenger cars.

I now drive the car every day, through traffic and on the highway. The original cost was $30,000.

BEN H. HUDSON

Hapeville, Ga.

### Bringing Up the Rear

Sir:

It seems to me that the Orientals, possibly the Japanese, were 'way ahead of us on the caboose with bay windows you reported in November, p. 127. I ran across this type of caboose some three years ago while serving in the occupation of Korea, formerly a protectorate of Japan. And from the looks of the ones I saw and rode in, they had been in existence a very long time before my arrival.

H. M. PROFFITT, JR.

Belleville, Ill.

### Time Stands Still

Sir:

In his article "I Fly the World's Fastest Bomber," on p. 139 of your November issue, test pilot Jim Fraser says: "You could have had breakfast in New York and 46 minutes later, according to your watch, had breakfast again—in Los Angeles."

That statement seems to be based on the

# INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

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LAWRENCE JOHNSON

Walla Walla, Wash.

*Author-pilot Fraser assumed that a traveler flying westward would set his watch back an hour three times on passing from one time zone into another. Thus he could eat breakfast at 6 a.m., New York time, and--3 hours 46 minutes later--eat again at 6:46, Los Angeles time.*

**How 'Chute Brake Works**

Sir:

Your article on the B-47 (Nov., p. 139) leaves me with only one question: Just how is that parachute, used to slow the plane in landing, controlled so as not to touch the ground?

During the war I was a glider pilot, and I believe we were the first to use parachutes on the tail to slow landing speed. But we released the 'chute near the ground to prevent it from dragging and snaring. Thus the 'chute could be used over again.

In your picture of the B-47, I don't see how it is possible for that 'chute to be kept off the ground.

WAYNE CURTIS

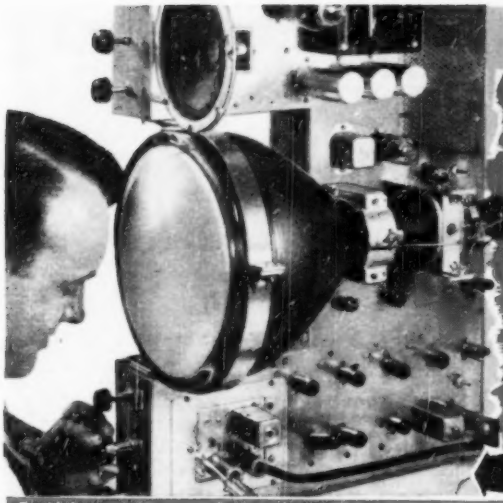
Montrose, Colo.

*Your gliders were powerless, producing no air blast to keep their 'chutes extended. The B-47, however, has six jets that blow quite a gale even when idling. This blast prevents the bomber's 'chute from touching the ground until the engines have been shut off. For similar use of a parachute as a landing brake on another jet bomber, see p. 111 in this issue.*

**Ham Ohmlet**

Sir:

I have read PS almost constantly since 1929, but the most fascinating article I ever read in it was the one on p. 242 of your November issue, "Hide a Radio in a Skillet."



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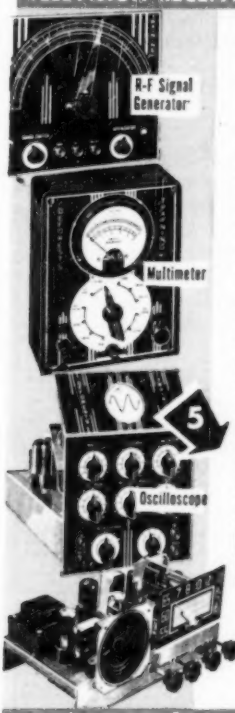


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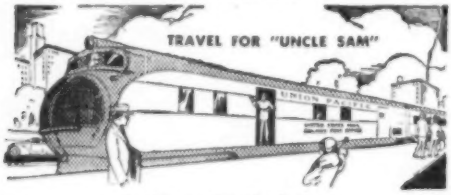


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CLYDE A. ARMS

Brooklyn, N. Y.

**Smaller, Faster Workhorse**

Sir:

The truck pictured in the upper left corner of p. 122 of your November issue, in the article "Army Breeds New Line of Combat Workhorses," looks more like the descendant of a GI 1½-ton truck than of a 2½-tonner. The 2½-ton truck, according to the way we saw them in France, had dual rear wheels and a rear compartment almost high enough to accommodate a man standing.

EUGENE H. MITCHELL

Dallas, Tex.

*The fact that the new 2½-ton truck is smaller and faster than its wartime ancestor, yet carries the same load, points up the improvements resulting from the Army's "selective breeding." Physically, the new 2½-tonner does resemble the old 1½-ton truck. It also resembles the new 1½-ton model, except that it has a longer wheelbase and a longer bed.*

**Credit Where Due**

Sir:

The Hypro® planer described on p. 113 of your November issue, in the short article titled "Wing Trimmer Pares Pounds," is manufactured by the Cincinnati Planer Co., a wholly owned subsidiary of the Giddings & Lewis Machine Tool Co.

S. L. LITTLE,

Giddings & Lewis Machine Tool Co.
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*The information erroneously crediting development of this tool to another manufacturer of similar name was furnished to our Western Editor by North American Aviation, Inc., in whose plant our photo showed the planer being used.*

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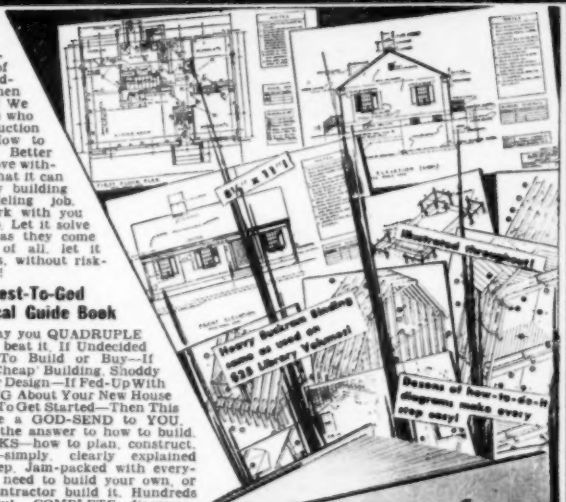


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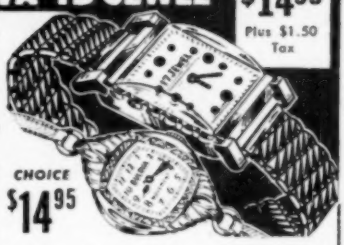

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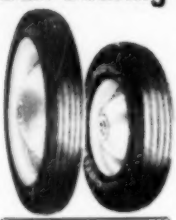

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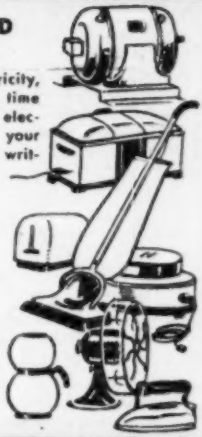

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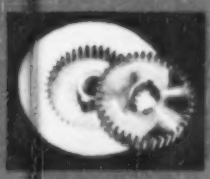

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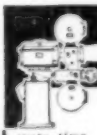

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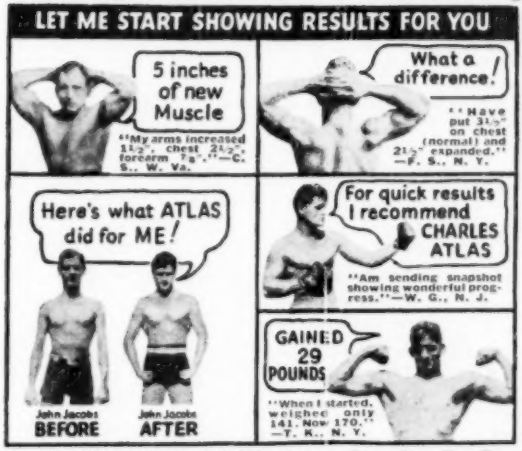


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6-8-10-12-14-16 PLY "ALL-PURPOSE" "AAA" GRADE
**GOLDEN RULE 26 MONTHS REPLACEMENT GUARANTEE BOND**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 600-20 | $ 9.20 | 32x6 (8) | $11.95 | 900-20 | $15.55 | 34x7 | $12.22 |
| 650-20 | 9.99 | 32x6 (10) | 13.33 | 1000-20 | 16.65 | 1000-22 | 17.77 |
| 700-20 | 10.85 | 825-20 | 15.95 | 1100-20 | 17.77 | 1100-22 | 18.88 |

**MILITARY "AAAA" guar. 30 mos. (Supers 16 mos.)**

| | | | | | |
|---|---|---|---|---|---|
| 750-16 | | 900-16 | | 750-20 | |
| Super "AAAA" | $ 9.75 12.22 | Super "AAAA" | $ 8.60 10.90 | Super "AAAA" | $ 9.48 13.00 |

Mud-Snow 2-1 Tred 600-16 $7.77

**BLATT** GIRARD & LANCASTER AVES., DEPT. PS BLATT BUILDING PHILADELPHIA 31, PA.
Send ck. or money order and this ad for rush shipment. We won't ship a tire we wouldn't use ourselves. Instant shipment down south. For West and the world over. The name to trust in rubber.

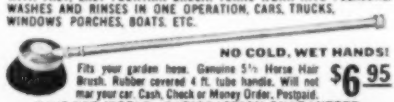
# WALKIE TALKIES $2.99 SET OF 2
**POCKET SIZE —ELECTRONIC VOICE POWERED**

**No tubes, batteries, adjustments, license or permit needed!** Should last for years. **Guaranteed to work anywhere** up to ¼ mile with extra wire. Clear tone. **Swell for room to room—garage to house, etc! Your own private, talk-listen phone. Not war surplus. Brand new.** Solid Aluminum Case. **Guaranteed. Two absolutely complete units with wire—READY TO USE!**

**SEND $1.00** deposit and pay postman $1.99 plus postage charges or send $3.25 for postpaid delivery. **Ideal gifts for boys—girls. Order Now! Today!**

**THE MIDWAY COMPANY, Dept. WPS-2, KEARNEY, NEBRASKA**

# WASH YOUR CAR IN 10 MINUTES!
**WITH FAST, EASY FOUNTAIN BRUSH. TURNS WORK INTO PLEASURE. WASHES AND RINSES IN ONE OPERATION. CARS, TRUCKS, WINDOWS, PORCHES, BOATS, ETC.**



**NO COLD, WET HANDS!**
Fits your garden hose. Genuine 5½ Horse Hair Brush. Rubber covered 4 ft. tube handle. Will not mar your car. Cash, Check or Money Order. Postpaid. **$6.95**
**PAYS FOR ITSELF—SATISFACTION GUARANTEED**
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## BE A BROKER

**PAYS BIG! SEND FOR FREE, BIG, ILLUSTRATED CATALOG NOW!** No obligation. Graduates report making substantial incomes. Start and run **your own business quickly.** Men, women of all ages, learn easily. Course covers Sales, Property Management, Appraising, Loans, Mortgages, and related subjects. **STUDY AT HOME** or in our classrooms in big cities. Diploma awarded. G.I. approved. Nationally known.

**FREE BOOK TELLS HOW**

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## SIMPLE, EASY TO USE

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# Get Into RADIO, TELEVISION and ELECTRONICS
## Master ALL Phases

**Get Complete Training. You Receive and Keep All Tubes, Equipment, Parts and Lessons. No Extra Charges.**

You receive complete standard equipment, including latest type High-Mu Tubes, for building various experimental and test units. You progress step by step until you build a complete Superheterodyne Receiver. It is yours to use and keep.

**YOU RECEIVE THIS PROFESSIONAL MULTITESTER!**

You will use this professional instrument to locate trouble or make delicate adjustments—at home—on service calls. You will be proud to own this valuable equipment. Complete with test leads.

**SIGNAL GENERATOR**

You construct the Transitron Signal Generator shown here, demonstrating Transitron principles in both R.F. and A.F. stages. You study negative type oscillators at firsthand.

**AUDIO OSCILLATOR:**

An electronic device, which produces audio-frequency signals for modulating R.F. (radio frequency) carrier waves, testing A.F. (audio frequency) amplifiers, speakers, etc.

**T.R.F. RECEIVER**

You build several T.R.F. Receivers, one of which, a 4-tube set, is shown here. You learn construction, alignment, make receiver tests, and do trouble shooting.

**GOOD PAY and Unlimited Opportunities in JOBS LIKE THESE:**

Business of Your Own
Radio Manufacturing, Sales, Service
Broadcasting Telecasting
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Laboratories: Installation, Maintenance of Electronic Equipment, Electrolysis, Call Systems
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Theatre Sound Systems Police Radio
**And scores of other good jobs in many related fields**

**YOU CONDUCT MANY EXPERIMENTS LIKE THESE!**

Checking action of condensers
Experiments with AF and RF Amplifiers
Experiments with resonance
Producing beat frequencies
Calibrating oscillators
Experiments with diode, grid-bias, grid-leak and infinite impedance detectors
Practical experience in receiver trouble shooting
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Experiments with audio oscillators
Advanced trouble-shooting
. . . and many, many others

**Complete Training by Practical Resident Trade School, Est. 1905**

The same highly trained faculty, instruction materials and methods used here in our large, modern resident school, are adapted to your training *in your own home*. Shop Method Home Training has been proved by hundreds of successful graduates.

*Both Resident and Home Study Courses Offered*

**YOU LEARN BY DOING**

You receive special laboratory experiment lessons to show you how to build with your own hands various experimental units such as those shown at left, and how to conduct many tests.

You will find all lessons easy to understand because they are illustrated throughout with clear diagrams and step-by-step examples that you work out yourself. Every piece of the equipment and complete lesson material we send you is yours to keep and enjoy, including the multitester, experimental equipment, all parts of the Superheterodyne, tube manual, radio dictionary, and complete, modern Television texts. All parts are standard equipment.

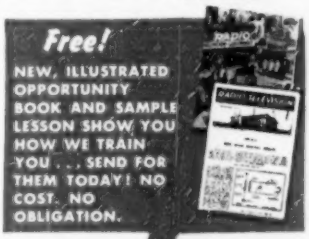
**Shop Method Home Training . . . Earn While You Learn**

With our practical resident Shop Method Home Training, you study in your spare time. You receive Spare Time Work Lessons, which show you how to earn while you learn. Service neighbors' radios and TV receivers, appliances, etc., for extra money and experience. Many National students pay all or part of their training with spare time earnings!

**DON'T DELAY! The Radio-Television Industry needs trained men NOW!**

**APPROVED FOR VETERANS!** Check coupon below!

**For quick action, mail coupon today and we'll rush you full information.**

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LOS ANGELES 37, CALIF. • EST. 1905

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**National Schools, Dept. PS-2**
**4000 South Figueroa Street**
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*Mail in envelope or paste on penny postal.*

Send me your FREE book "Your Future in Radio" and the sample lesson of your course. I understand no salesman will call on me.

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ADDRESS .....
CITY ..... ZONE ..... STATE .....

☐ Check here if Veteran of World War II

# *New* Advertising Machine

## PRINTS and ILLUSTRATES

### 1¢ Post Cards

**FREE** Learn *how* thousands of business men, in every line, are boosting sales in spite of conditions—with 1¢ messages—printed and illustrated in a few minutes on gov'nt post cards — with amazing new patented **CARDMASTER.** Your "today's" ideas, read by your prospects next morning. Not a toy, but a sturdy advertising machine, built to last for years. Low price, sold direct. Guaranteed for five years. Send name today.

**SEND NAME** We'll send **FREE** illustrated book of money-making IDEAS for your business and complete, unique advertising plans. RUSH YOUR NAME TODAY.

**CARDMASTER COMPANY**
1920 SUNNYSIDE, Dept. 162, CHICAGO 40, ILL.

# ACCOUNTANT

BECOME AN EXPERT

Executive Accountants and C. P. A's earn $3,000 to $10,000 a year. Thousands of firms need them. We train you thoroly at home in spare time for C. P. A's examinations or executive accounting positions. Previous experience unnecessary. Personal training under supervision of staff of C. P. A's. Placement counsel and help. Write for free book, "Accountancy, the Profession That Pays."

**LASALLE Extension University, 417 So. Dearborn St.**
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OUR GUARANTEE
OUR TIRES must make good or WE WILL
Tube Given With Each Tire
EVERYONE TAKE 10% DISCOUNT
ON ALL TIRES

Be Wise—Read this Before You Buy!
OUR EXPERIENCE ASSURES YOU THE BEST BUY IN
GOOD USED TIRES
BUY IN CONFIDENCE
selected POPULAR BRANDS—
positively NOT Re-caps or Re-molds.

| | | | | | |
|---|---|---|---|---|---|
| 5.50-17 | $5.02 | 6.70-15 | $6.75 | 7.50-16 | $7.62 |
| 6.00-16 | 5.02 | 6.70-16 | 6.75 | 7.60-15 | 7.62 |
| 6.50-15 | 5.02 | 7.00-15 | 5.30 | 7.60-16 | 7.62 |
| 6.50-16 | 5.02 | 7.00-16 | 6.30 | 8.20-15 | 8.62 |

GOOD TREAD—NO RE-CAPS. THESE TIRES WILL CARRY YOU TWICE AS FAR!

| | | | | | |
|---|---|---|---|---|---|
| 6.50-20(6) | $9.22 | 8.25-20(10) | 15.52 | 11.00-20(12) | $16.42 |
| 7.00-20(8) | 10.52 | 9.00-20(10) | 15.52 | 11.00-22(12) | 18.42 |
| 7.50-20(8) | 10.52 | 10.00-20(12) | 16.22 | 32x6 (8) | 10.02 |

750-20 MILITARY 8 PLY REGULAR $9.62—SUPER $12.92
900-16 MILITARY 8 PLY REGULAR $8.72—SUPER $10.92

Thousands of Tires Shipped to Satisfied Customers Throughout United States and Many Distant Points. Send This Ad with Check or Money Order. Dep't S.

**STANDARD** 834 N. Broad St., Philadelphia 30, Pa.

# New FALSE PLATE for OLD IN 24 HOURS

*Low As Only* **$18.50**

***Wonderful New Scientific Method Transforms OLD, LOOSE, Cracked or Chipped Plates into* LUSTROUS BEAUTY-PINK DUPONT PLASTIC PLATES**

***NO IMPRESSION NEEDED***

Why envy beautiful false teeth of others? We will transform your old, loose, cracked or chipped plate into a beautiful new, lightweight DuPont Beauty-Pink Plastic Plate, using your own teeth. All missing and broken teeth matched and replaced. Your cost amazingly low; actually save many dollars. No impression needed under our new scientific False Plate Method. 24-Hour Service. Perfect fit guaranteed.

**SEND NO MONEY** Enjoy life again, and save money on beautiful, new, natural-looking **plastic** plate. Rush name, address for full details sent FREE. If your plate is loose, we show you how to make it comfortable, tight-fitting before duplication.

**West Dental Laboratory, 127 N. Dearborn St., Dept. P-34, Chicago 2, Ill.**

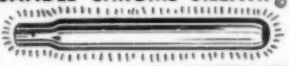
# "How to Make Money with Simple Cartoons"

A book everyone who likes to draw should have. It is free; no obligation. Simply address

FREE BOOK

**CARTOONISTS' EXCHANGE**
Dept. 192-D Pleasant Hill, Ohio

**SANDEE CHROME SILENTIP©**



**$2.95** EACH

**FOR QUIETER PERFORMANCE**

**An exhaust tailpipe extension that is actually a small muffler. Chrome plated. Will make a sport muffler or dual set quieter and still give straight thru performance.**

**SANDEE MUFFLER CO., 5643 Corryne Pl., Culver City, Calif.**

# *FREE SAMPLES!*

## *GLOW IN THE DARK!*

BIG PROFITS showing amazing Luminous Specialties—house numbers, pictures, plastic novelties, religious and nursery objects, ash trays, keyholders, etc. Large manufacturer. Enormous demand. Sell on sight. WRITE AT ONCE for FREE samples.

**Madison Mills, 303 4th Ave., Dept. F-5, New York 10, N.Y.**

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# AVIATION CAREER

IN SUNNY SOUTHERN CALIFORNIA

**MAXIMUM TRAINING IN MINIMUM TIME**

Specializing in AERONAUTICAL ENGINEERING and MASTER AVIATION MECHANICS since 1929 . . . America's Finest Aeronautical Institute . . . 7000 successful graduates . . . MAKE MORE MONEY . . . MAIL COUPON TODAY. APPROVED FOR VETERANS. Board and Room now available.

*Without obligation, send free catalogue with full information.*

PS-2

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**CAL-AERO TECHNICAL INSTITUTE**
GRAND CENTRAL AIR TERMINAL • GLENDALE 1, CALIFORNIA

**SALESMEN!**

# SALES GOING CRAZY!

**Work hard for 7 months**
**...then LOAF the rest of the year!**

## AMAZING *Underground* SPRINKLER SYSTEM—

**Retails for ONLY... $49.50**

Everspray Installed at North Acres Gardens, Anderson, Indiana

**...SWEEPING SALESMEN INTO THE BIGGEST MONEY OF THEIR LIVES! "GOLD MINE" FOR DISTRIBUTORS!**

*Last* year, EVERSPRAY created a nation-wide sensation — poured spectacular profits into the laps of salesmen everywhere.

*This* year, the NEW, *Improved* EVERSPRAY is going to make last year's earnings look like small change! Because *this year*, we offer Salesmen TWO spectacular order getters until now unheard of in the history of Direct Selling.

1. **A COMPLETE DEMONSTRATOR *you carry right in your pocket.***
2. **An Everspray SYSTEM complete in every detail that you can spread out on a prospect's lawn and have in full operation IN LESS THAN 10 MINUTES!**

*This* year—*right before a prospect's very eyes*—you can show him exactly how his Everspray Underground Sprinkler System is going to work *when it's installed in his lawn!*

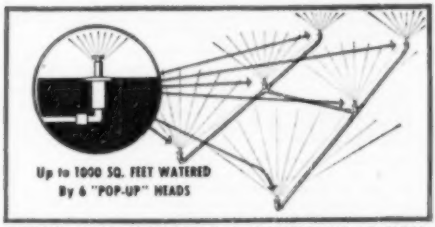
With *either one* of these two amazing demonstrations **you clinch a sale 9 times out of 10.** Every home owner who takes a speck of pride in his lawn will want to install an Everspray as quick as it can be delivered to his door!

**"People Tell Me I Have the Finest Lawn They've Seen in Years"**
**—*writes Mrs. L. G. Johnson***

"When my Everspray is in operation, people actually stop their cars to watch it and to admire the smooth, velvety green texture of my lawn. I never saw anything like Everspray in all my life."

And R. C. Freeman, Chicago, says: "It's amazing how EVERSPRAY keeps our lawn in tip-top condition all season long. Best of all, I don't have to waste hours of time sprinkling with a garden hose."

## CUSTOMER INSTALLS IN FEW HOURS *without damage to lawn!*




Now, for the first time in history, any home owner—anywhere—can get an Underground Sprinkler System at a price he can afford. Now his lawn can be sprinkled like a million-dollar estate. And look! Everspray is all solid brass and copper. Nothing to rust or wear out. No pipe fitting to do. No plumber's bills to pay. No repairs. No inspection. No maintenance. No freezing because Everspray *drains itself*—automatically—every time it's shut off. No wonder home owners by the thousands are rushing to buy Everspray!

No wonder Ray J. Eckenrode says: "EVERSPRAY works like a charm. On the strength of this installation, a neighbor asked me to purchase the same layout for him."

**DON'T CALL YOURSELF A SALESMAN IF YOU CAN'T MAKE**

## $60.00 A DAY!

In the NEW Improved EVERSPRAY you've got your hands on the biggest summer seller ever invented. When most lines are dead or dying, *Everspray is just coming to life!* Our sure-fire "Jack-Pot" Pyramid Sales Plan turns your *first* sale into TEN or more. Then *EXTRA* orders start pouring into your hands *automatically—without a bit of effort on your part!*

***How to get an* EVERSPRAY *for your own use***

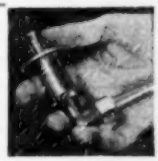
If you want an Everspray for your own use, ask about Special User-Agent Plan that shows how you can get a complete system without a penny's cost to you. Ask for "Confidential User-Agent Plan" when you write or mail coupon.

### *FREE!* SEND NAME

This very minute, send your name on the coupon or penny postcard for beautiful Illustrated Folder that shows pictures of *actual Everspray* installations, Demonstrator Offer and Details of sure-fire "Jack-Pot" Pyramid Sales Plan. Everything is FREE. No charge now or ever. Time is precious. Send name today.

**CARRY COMPLETE DEMONSTRATOR RIGHT IN YOUR POCKET!**

You can't believe it until you see it. We show you how to use this amazing "POP-UP" Sprinkler Head to make a Demonstration, right before your prospect's very eyes! Special Demonstrator Offer sent *FREE*. Just mail postcard or handy coupon.



John Oakman, Sales Mgr.
EVERHOT PRODUCTS CO., (Everspray Division) Dept. 7-B
2001 Carroll Ave., Chicago 12, Ill.

Rush Illustrated Folder, Demonstrator Offer and details of your "Jack-Pot" Pyramid Sales Plan that offers me an opportunity to make $59.40 a day on only *3 sales*. Everything is FREE and costs nothing now or any other time.

☐ Please send me "Confidential User-Agent Plan"

*Name*.....

*Address*.....

*City*..... *Zone*.... *State*.....

**EVERHOT PRODUCTS CO.**
**(Everspray Division)**
**2001 Carroll Avenue, Dept. 7-B, Chicago 12, Illinois**

# Do you want

## ..to go to College?

## ..or to enter a Profession?

*(Such as Accounting, Architecture, Nursing, Dentistry, Teaching, Social Work, Osteopathy, Beauty Culture, Optometry, Embalming, Chiropody, Law, Medicine, etc.)*

## ..or get an Office Position?

To get anywhere, you practically MUST finish High School FIRST. You can complete our simplified High School Course in SPARE time at home, as FAST as your time and abilities permit. Equivalent to resident school work—prepares you for college, pre-professional examinations, business, industry. Standard texts furnished. Diploma. Credit for H.S. subjects already completed. Single subjects if desired. Low tuition, easy terms. American School, Chicago, est. 1897—endorsed by educators. Finish your high school education NOW. Write TODAY!

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**Many Finish in 2 Years**

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Gentlemen: Send me FREE information covering special training in subjects checked below. No obligation on my part.

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- ☐ Elec. and Gas Refrigeration
- ☐ Air Conditioning
- ☐ Railway Training
- ☐ Diesel Engineering
- ☐ Drafting and Design for Men and Women
- ☐ Plastics
- ☐ Private Secretary
- ☐ Mechanical Engineering
- ☐ Aviation
- ☐ Salesmanship
- ☐ Radio

*Name*.....

*Address*.....

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*With* **TECH**

*the New*

**CREATIVE MODEL MAKER**

An amazing NEW construction set of durable colorful plastic! Makes an immediate hit with the youngsters because it is so **simple and easy to assemble** without screws, bolts or nuts. A marvel for the model maker because parts are **precision engineered** to 1/1000 of an inch accuracy. Duplicates appearance and action of actual machines with fascinating realism. Gears, wheels, pulleys, girders, blocks, LOOK and WORK like real ones. Finished models may even be operated electrically. Erect engines, lathes, cranes, airplanes and 100 other designs that come with set or develop models of your own invention. Parts are big and strong, marproof, non-fading, brilliantly colored clear through. Don't wait! **Get a TECH Creative Model Maker**—now—and enjoy endless **hours of instructive entertainment.**

Regular price $6.00

***Special NOW***

**$3.49**

**TECH, 6602 Lexington, Hollywood 38, Calif.**

Gentlemen: Please rush me ..... sets of TECH, the creative Model Maker, complete with FREE 48-page color illustrated model makers guide, for which I enclose.....

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Find out about these sensational new Conn Band Instruments. Many wonderful, exclusive features! Today, *more than ever*, Conns are the "Choice of the Artists." You'll advance faster and take more pride in a genuine Conn—made by the world's largest manufacturer. See your dealer or write us for free literature. Mention instrument. Conn Band Instrument Division, C. G. Conn Ltd., 232 Conn Building, Elkhart, Indiana.

*Write* FOR FREE FOLDER

CONN BAND INSTRUMENTS

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**To make Crowns, Plates, Bridgework, etc., for Dentists.** Easy practical way to learn mechanical dentistry at home in spare time. FULL EQUIPMENT OF TOOLS AND MATERIALS INCLUDED WITH COURSE. Low tuition. Easy terms. Write for FREE BOOK about this money making profession that is not affected by the machine age.

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In California's loveliest Garden Spot, on scenic shores of beautiful Morro Bay. Enjoy future independence with excellent soil, soft water, wonderful fishing, hunting, boating, bathing, etc. Grow fruits, vegetables, poultry. Perfect temperate climate. Congenial community. Finest investment. Free literature.

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Advanced method has healed thousands. No leg straps, no elastic, no plasters. No pressure on hips or spine. Flexo-pad. Entirely different. Endorsed by doctors, mechanics, clerks. Very light. **INEXPENSIVE. GUARANTEED.** Write for information and trial.

**SMITH MANUFACTURING COMPANY**

**EST'D 1893 Dept. PS, Preston, Ont. Can.**

**NEW AUTOMOTIVE DISCOVERY**

## FREE TRIAL IN YOUR CAR!

**FITS ALL CARS**

REPLACES IDLE ADJUSTMENT SCREW IN YOUR CARBURETOR

THE AMAZING NEW GANE "air-flow" NEEDLE

THE OBJECTIVE IS TO GIVE YOUR CAR

- ✓ MORE MILEAGE
- ✓ FASTER PICK-UP
- ✓ EASIER STARTING
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***Install it* YOURSELF** in only 5 minutes

Up to 25% MORE MILEAGE, EASIER STARTING, FASTER PICK-UP, and SMOOTHER IDLING—many users report with this SENSATIONAL NEW automotive product. NOW, test them ***in your car*** AT OUR EXPENSE. Check mileage and engine performance. If satisfied (as ½ **MILLION** other users are) send $1.50 per needle (8 cyl. cars take 2). If not entirely satisfied—just return them:—FAIR ENOUGH? Send card TODAY—specify MAKE of car and carburetor. **SEND NO MONEY—TRY BEFORE YOU BUY—PAY POSTMAN NOTHING.**

**NATIONAL AUTOMOTIVE RESEARCH CO.** Dept. H-2, Venice, Calif.

## NEW OPPORTUNITY FIELD

The fast-growing field of **Television**—the new development in the Radio field offers unlimited opportunities today. **Coyne** offers a separate course in **Radio-Television**, Installation, Testing, Trouble-Shooting and Service on Radio, F.M., and Television equipment. Get big free book today.

## *Get into the* OPPORTUNITY FIELD OF ELECTRICITY

**For many years Electricity has been a most vital factor in industry. This great field will continue to grow and become more important. Thousands of trained Electrical men will be needed. Why be satisfied with a "no future" job? Prepare for a good job with a real future in Electricity.**

## Coyne Trained Men in Good Jobs

Thousands of **Coyne** trained men in good jobs or in a business of their own in Electricity and Radio-Television, make real money while others putter along. Yes, you can get ready for Good Pay—a Big Future—by training at COYNE here in Chicago. Here you work on real equipment—do actual wiring and trouble-shooting — get the practical-technical training you need.

### Not "Home-Study"

We do not teach by mail. All training is given in our Great Training Shops in Chicago, plus necessary theory. Expert instructors guide you. No advanced education or previous experience needed.

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COYNE courses are approved under the G.I. Bill. Non-veterans may enroll now, pay most of tuition after graduation. If you need part-time work to help out with living expenses while at **Coyne**, we'll help you get it.

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Whether you prefer Electricity, or Radio-Television, train on actual equipment, at **Coyne.** We have a big, fully illustrated book on each course, and we'll send you the one you want, or both, without obligation. Mail coupon — TODAY.

**B. W. COOKE, President, COYNE ELECTRICAL & RADIO SCHOOL. 500 S. Paulina St., Chicago 12, Ill. Dept. 20-73H**

**B. W. COOKE, President**
**COYNE ELECTRICAL & RADIO SCHOOL, Dept. 20-73H**
**500 S. Paulina St., Chicago 12**

Send FREE, the book checked below, and details of your training offer. This does not obligate me and **no salesman will call.**

☐ ELECTRICITY ☐ RADIO-TELEVISION

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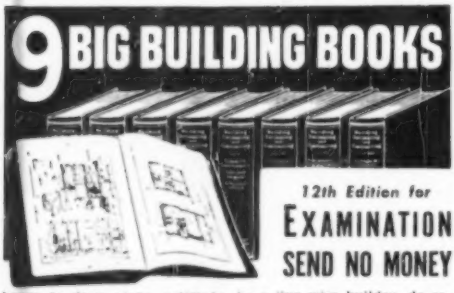

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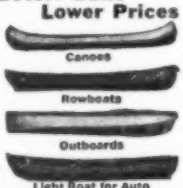


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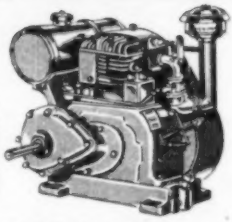

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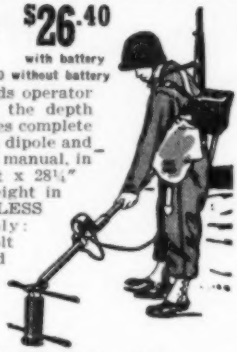

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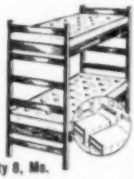

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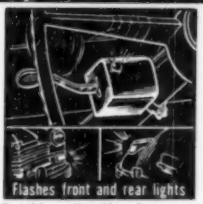


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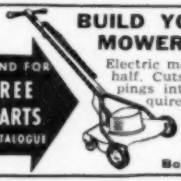

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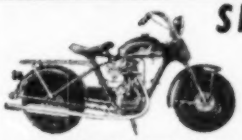

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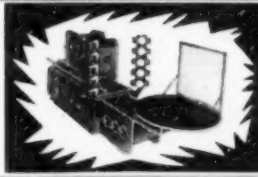

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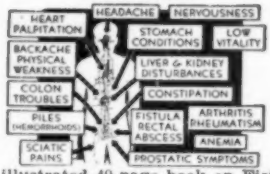


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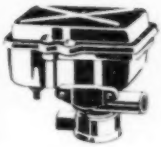

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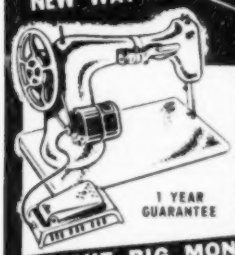

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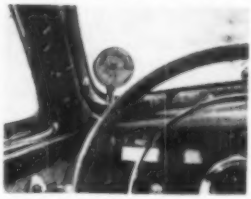

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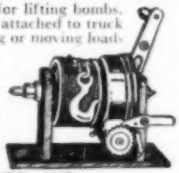

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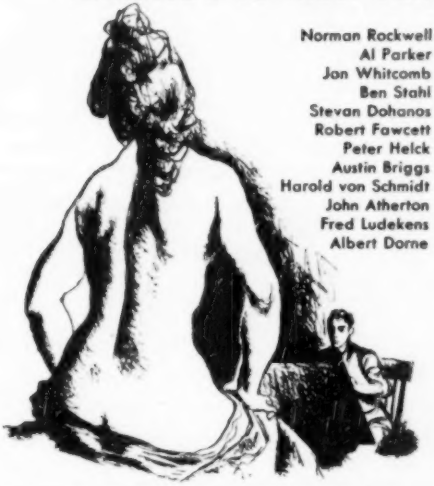

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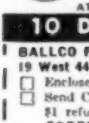

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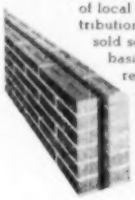

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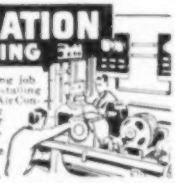

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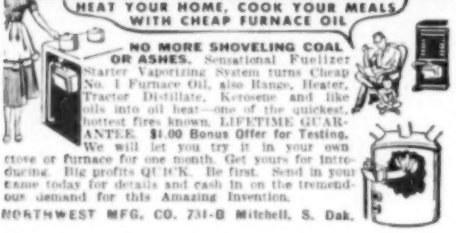

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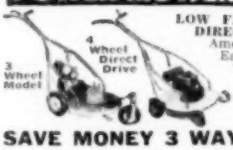


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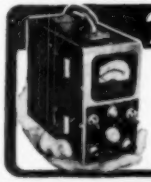

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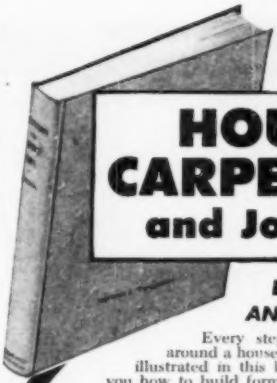

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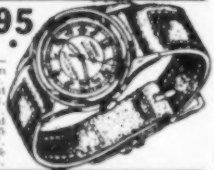

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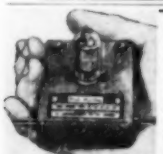

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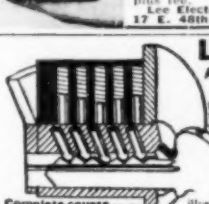

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WANT a Business Of Your Own? Make $20 to $30 a week extra money at home! Thousands Do! Interesting service cleaning upholstery and rugs. Big Demand. No selling. "Free illustrated folder tells how." American Company, Inc., Dept. H-20, 211 North 7th Street, St. Louis, Missouri.

TIN Cans. Turn them into cash. Nine methods. Instructions 50c. Charles, 12-BAC, Norwood, Ohio.

SAWDUST. Turn it into cash. Six methods. Instructions 25c. Charles, 12-BAE, Norwood, Ohio.

HOW and where to obtain Capital? Free details. Star Service, Wapakoneta, Ohio.

BOOKKEEPERS earn $100.00 week operating your "Bookkeeping Service". Simplified plan. Information free. Bookkeeping Service, Box 664-P, Springfield, Mo.

MAILING postcards selling repeat merchandise is profitable. Everything supplied. Details free. Gordon Publishers, Box 23, Pawtucket, R. I.

PIANO Tuning — Home Study — (15th year). Empire School, Champaign, Illinois.

BE a Cartoonist. A Fortune may await you. Write for free circular. Chas. J. Sprusil, 97-42 43 Ave., Corona, L. I., N. Y.

DESIGN-Model-Mold new fast sellers from Plastics, Plasters, Compositions. Amazing profits. Quick returns. Free literature. Simplex System, 2925-K Michigan, Kansas City 3, Mo.

NEW. Proved methods get money by mail. Amazing, eye-opening. Details free. Lexington Mail, 5538-B Lexington, Chicago 44.

MAKE Perfume At Home? Write Carey Laboratories, 1914 Chouteau, PS 2, St. Louis 3, Missouri.

GET Into Pleasant Home Operated profitable business, working by mail. Everything furnished! Tremendous possibilities! Get exciting details. National, Box 88-N, Dorchester 22, Mass.

REAL money making opportunity making Interlocking Concrete building blocks. Rex Products Co., Dept. 21, Piqua, Ohio.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write, Woodart, Bridgewater, Massachusetts.

WHERE to buy 500,000 articles wholesale. Details free. Krueger, 3418B Wolcott, Chicago 13.

BRONZED Baby Shoe Mountings. Equipment and Supplies. We manufacture world's largest assortment of all metal mountings. Wholesale only. Ramyr Selenium Platers $39.95. Gold and Silver Plating Assemblies low as $97.50. Write for Free copy of Electroplating Instructions. Sales Division, Hollywood Bronze Supply, 1770 N. Vermont Ave., Hollywood 27, Calif.

DECORATE discarded furniture and tinware for Home or Profit. Free Details. Stewart's Budgewater, Mass.

NEW Type Filter That Fits Into Hot-Air Register. Easily Installed. Keeps Atmosphere Dust-Free. Ends Halo of Dirt Which Accumulates Around Register. Free Literature. Modern Metal Products, Warren, Ohio. Wholesale Hardware Distributors Wanted.

LIKE to Make Extra Income at Home? Proven Mailorder Plans Show How. Free Details. Perry Publications, Wenatchee 2, Washington.

WATCHES, Elgin, Waltham, other outstanding brands. Expertly reconditioned, priced low for quick, great profits! Send for FREE catalog. Plymouth Jewelry, 163P Canal St., New York 13, N. Y.

METALLIZE Baby Shoes. Excellent profits. New system assures success. Free details. Treasures Forever, 38 Michigan Ave., Lynn, Mass.

MORE Money—Easier! Revolutionary methods make public bookkeeping easy, interesting, profitable. Earn to $5.00 hourly within short time! Simple, complete instructions. Full-spare time. Success-revealing information free. Auditax Systems, 10775 V Tabor, Los Angeles 34.

$5,000 YEARLY. Operate Candy Cigar Store. Small investment. Send $1.00 "Your Store"—Book on retailing. Dept. S 198-09 Hollis Ave., Hollis 7, N. Y.

MAILORDER failure? My simple "Magic Formula" works miracles! Write: President, The Mailord Company, 204-A East 81, New York 28, N. Y.

BEST Source For Nylons. Rich Supply, 215 W. 98, New York 25.

LIQUID Marble—Colorful, glossy! Molded, Brushed, sprayed! Cast Novelties, Statuary, Colored Tiles, Flexible Molds, Composition Floors. Particulars Free. Marbelizing Service, Edwardsville, Ill.

BABY Shoe Mountings: "All metal. Latest Design. Photo Frame. Bookends. $2.50 each. Sample $2.25. Hampton Enterprises, 135 Clendenny Ave., Jersey City.

BUY Wholesale. Big-Name Items Up To 40% Below Retail. Folks Eagerly Buy Through You To Get Big Savings. Details Free. Young's, Kent 2, Ohio.

## 57 MONEY MAKING OPPORTUNITIES

DETECTIVES Earn Big Money. Experience unnecessary. Particulars free. Wagoner, P-125, West 86th, N. Y., N. Y.

SCHOOL Seniors—Earn 40% commission selling classmates America's Most Beautiful Graduation Name Cards. Largest selection. Outsells all others. Free sample kit. Printcraft, Dept. M, 1423 E. Elm Street, Scranton 5, Pa.

WANT Notary Public appointment? Official in usually 10 days. Stationers Exchange, Boerne 50, Texas.

SEWING Machine Business Tops. Big money—not crowded. Spare time home set-up. Repair course, new machines, motors, etc., wholesale. Hurry. Taylor Service, PS, Hamilton, Ohio.

RAISE Ginseng. Roots Bring Fortunes. Circular. Fezler Seed Company, Patchogue, New York.

"URANIUM—is currently the world's most-prized material. Full particulars Free. Write Sharpe, Prospector, Box 142, North Battleford, Canada."

NEW way. Earn $50 weekly working at home. We show you how. Ability in simple arithmetic essential. Write for literature. Dollar-a-Month Plan, Box 5236-B, Phila. 26, Pa.

# POPULAR SCIENCE OPPORTUNITIES

OPERATE concessions at carnivals, shows, fairs. Free details. Stampico, Detroit 4, Mich.

WIN Contest Money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

DELIGHTFUL Plans! Australia, South American. Free Book "372 Unusual Worldwide Business." $800.00 month reported. Work home (U. S. A.)! Get surprise! Publishers, Carlsbad, Calif.

"OPPORTUNITIES Preferred Magazine" tells how. Sample 25c. Glen, Howel 5, Kentucky.

WOULD You pay 3%—first $350 made? Book "505 Odd, Successful Enterprises" free. Expect something odd! Pacific, Oceanside, Calif.

ELECTRICALLY Inclined? Make $100-$250 weekly installing, maintaining fluorescent lighting. Make beautiful lights for 50c each. Exclusive, inexpensive, illustrated instructions enables you to cash in on this fast growing industry. Request impressive evidence on this proven business opportunity. Wilber Distin "Fluorescent", 401 Foote Bldg., Syracuse 2, N. Y.

"WESTERN Advertiser" offers many worthwhile moneymaking opportunities. Sample copy—3c. Harold E. Edlund, 577 Kensington, Los Angeles 26, Calif.

HAVE your own big-money business! Others are making up to $500 monthly in waterproofing and cement painting. Let me prove you may do as well! Few dollars starts you. Interesting facts free. Write today! Edgar W. Thomas, Barnesville 1, O.

EARN Money evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle (2) Wisconsin.

MEN-Women—"Everybody Likes Candy." Learn to make professionally. Details free. (Our 40th year.) Ragsdale Candies, D10, East Orange, New Jersey.

GET your copy of the new 1950 edition of the official Concessionaires Guidebook. 76 Pages, jam-packed with money making formulas, M.O. ideas, games and equipment for concessions, roadside stands, carnivals, etc. Send $1.00 to: Concessionaires Guidebook, Station H Zone 13A Toledo 6, Ohio.

## 58 FORMULAS, PLANS, ETC.

10,000 FORMULAS and trade secrets. Free Literature. Stillmans, 555 Kingston Ave., Brooklyn 3, N. Y.

LABORATORY tested formulas. Lists free. Pont, Box 635-PS, Terre Haute, Ind.

BE Independent. Fifty Valuable Formulas. Only $1.25 complete. Youngs Productions, St. Helens, Oregon.

FREE Formula Catalog anything analyzed $20.00. Western Chemical, Salem, Oregon.

## 59 PLASTICS

PLASTIC supplies, materials, instructions for hobby or business. Send for free catalog. Tells about internal carving. Hays Plastics, 2333 Lincoln Avenue, Alameda, California.

LUCITE, Plexiglas. Any size sheets, masked. Square foot (12 x 12) cost, 1/16" 86c; 1/8", $1.25; 3/16", $1.52; 1/4", $1.80. Colors add 10%. Include 10% postage. Almac Plastics, 230 Fifth Avenue, New York 1, N. Y.

INTERNAL Carvers—guaranteed fast cutting, high speed, tapered drills with sharp points that make carving easier. 1/16", 3/32"—$.60; 1/8"—$1.00 each postpaid. Send for literature. Bay Sales, 101 Fifth Ave., N. Y. 3, N. Y.

WHOLESALE Plastics supply catalog, 10c. Lucite clear, colored, Metallic Acetate, 15 colors. Thick Lucite cutoffs, polished blanks for carving. Metal findings, tools. Ideas, bargains galore. Quantity prices on Casting Plastic. Gem-O'-Lite, Box 686Y, North Hollywood, Calif.

PLASTIC Sheets, Rods, Tubes, etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

NEW Liquid Plastic. Clear, colors. Cast without heat. Embed flowers, insects, coins. Saw, drill, carve. Send 35c for exciting new home project manual showing how to get started. Castolite, Dept. B 102, Woodstock, Illinois.

PLEXIGLAS—Write for Free Price List. The Unique Glass Shop, 309 Cowardin Ave., Richmond, Virginia.

MAGNIFICENTLY carved plexiglas wall plaques 2½" x ¾" $3.39 pair postpaid. Free plastics Supplies Catalogue. Craft Plastics, Somerville, New Jersey.

INTERNAL carved roses, orchids, swans, goldfish, butterflies, etc. Jewelry and gifts. Crystal Floral Novelty Co., Bound Brook, New Jersey.

AMAZING! Internal carving drills, high speed steel, super fast cutting, professional type. Double spiral hand finished. 3/32" or 1/8". 75c each postpaid. Special! Any carving drill reconditioned 40c. Send for literature. Plasticrafter's, Dept. F, Box 68, Ft. Hamilton Station, Brooklyn 9, N. Y.

## 60 CHEMICALS AND APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting, Photo-Scales, Microscopes, Chemicals, Biological and Laboratory Supplies in Small Quantities. Catalog 15c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N. Y.

LUMINOUS Paints will glow in dark. Six colors. Fairmount Chemical Co., 136 Liberty St., New York City 6.

NEW, Used Catalog 10c refundable. Atlantic Laboratory Supply, 21 Wenham, Boston JP, Mass.

NEW catalog: Chemistry, mineralogy, biology, physics 10c. Tracey Laboratories, Evanston, Ill.

SNOOPERSCOPE Tube Permits nighttime vision. Tube and complete instructions $14.95. Infrared filters 15c. Voltmeter, Oscillator Kit Special $2.95. Precise, 942 Kings Highway, Brooklyn 23, N. Y.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 15c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 7, N. Y.

NEW Laboratory supply catalog of Chemicals and Apparatus. Contains many thousands of items with illustrations. Send 25c. Standard Science Supply Company, 1232 N. Paulina St., Chicago 22.

## 61 HELP WANTED

IMMEDIATE opening for reliable man with car to call on farmers. No experience necessary. $15 to $20 in a day. Permanent. McNess Company, Dept. 214, Freeport, Ill.

FOREIGN Employment. Construction men, building trades mechanics, helpers, office men. Good workers needed for oil projects, mining, pipe lines, dams, power plants, roadways, shipping, etc. Transportation and quarters furnished; high wages. Listings of firms actively working and hiring on projects in South America, Arabia, Asia, Africa, Alaska, Central American, etc. Send $1.00 for foreign construction compendium and application forms. Foreign Service Bureau, Dept. PS-2 Employment) P. O. Box 295, Metuchen, New Jersey.

INTERESTED in Latin American and Foreign Employment???? $1.00 Brings 1950 Copyrighted "Foreign Service Directory" with new complete listings in US & Canadian Construction Companies; Worldwide Oil Firms, Mining, Aviation, Steamship, Transportation; Manufacturers; Importers & Exporters; Domestic & Foreign Listings. Special Daily Listing of firms hiring. Tells How-When-Where to apply, application form. Global Reports, P. O. Box 883-S, Hollywood 28, Calif.

ALASKA—The Great American Frontier . . . offers unlimited opportunities. $1.00 brings 1950 Copyrighted Report & Government Map. Business Directory listing Big Construction Projects; Fishing; Mining; Aviation; Hunting—Fishing-Game rules; Fur-Farming; Lumber; Agriculture; Live Stock Raising; Transportation; Homestead & Highway information. Hot list of firms hiring. Alaska Opportunist, P. O. Box 883-S, Hollywood 28, Calif.

JOB openings, Industries presently hiring. Wages, Housing, Rentals, Living Costs, etc. Complete Information, $1. Free Map included if sent Today. Opportunities in California, Box 202-S, Los Angeles 34, California.

TAKE orders at home. Spill coffee or ink on 275 sq. inches of Free fabrics, demonstrating sensational tablecloth invention. Not ordinary plastic. Withstands 16 years cleanings. Styleco, Dept. 74, Cincinnati 10, O.

MAKE $20 a day! Complete line, Door name plates, knockers, numbers, Hubstamp, 359-B Congress, Boston, Mass.

## 62 AGENTS WANTED

PHOTO-Salesmen-Agents. Sell beautiful hand-colored plastic enlargements. Collect deposit, we deliver. Profitable sideline. Send card for free sample kit. Novel Portrait Co., 3343-A North Ave., Chicago, Ill.

SEWING Machine electrification kit. Nationally advertised. Has Good Housekeeping Guaranty Seal. Can be demonstrated and sold in 5 minutes. Make at least $5 per sale. For complete details write today to Brownell Distributors, Inc., Dept. PS, 308 Canal St., New York 13, N. Y.

BE Renewal Headquarters for all magazines. Big profit in Christmas gift sales now. No experience—No capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 510A, Mount Morris, Illinois.

NYLON, Poplin, Rayon Uniforms, white and colors. Immediate Delivery. Immediate Profits. Sell to Doctors, Dentists, Nurses, Waitresses, Beauticians, Housewives. Free Sales Kit. Superior Fabrics, Dept. A-1, 3936 Market St., Phila. 4, Pa.

FAST profits—No investment. Send for big, free catalog. Plastic aprons, tablecloths, etc. 150 sure-fire items. We guarantee sales. Write The Halliday Company, Dept. P-2, 347 Broadway, Passaic, N. J.

DRESSES 18c; Men's Overcoats $1.00; Skirts 50c. Free Catalog. Crown, 164-PS Monroe St., New York 2.

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, tie holders, complete line Police and Firemen's Badges. 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties, Box 1425, Dept. 7, Providence, R. I. Established 1926.

WHERE To Buy 800,000 articles direct from Manufacturers. Save by buying direct. Sent Free. "Your Profits Under the Spotlight." Glass Pub. Co., Ellwood City 3, Pennsylvania.

ADVERTISING book matches—Cash in on big demand—sell Union Label matches. Cuts for all businesses and political parties—Free powerhouse selling kit—low prices—protection guaranteed on repeat orders—Cash commissions. Superior Match Co., Dept. P-250, 7530 Greenwood, Chicago.

GOLD lacquered Window Sign Letters. Large Sizes Penny Each. New Foils. Absolutely Beautiful. Free Samples. Atlas, 544 W. 79th, Chicago 20.

MAKE Money Fast. Sell gorgeous, new Metal and $1 Plastic Greeting card assortments. 100 other sell-on-sight items. 21 All-Occasion cards for $1.00. Birthday, Easter, Relative cards. Wrappings, Scented Stationery, Gifts. Amazing profits. Bargain offers. Write for Samples on approval. Hedenkamp, Dept. PS-4, 361 Broadway, New York.

AMAZING Offer—$40 is yours for selling only 50 boxes. Also entirely different, new Deluxe All-Occasion assortment with television card, Little Pearls, Hankie Gift Greetings, other surprise items. Feature boxes on approval. Free samples imprinted stationery and Rose Scented Notes. Write today. It costs nothing to try. Cheerful Card Co., 1155, White Plains, N. Y.

BETTER way to extra money! Sell outstanding new Plastic, Metallic greeting cards, Gift Wrappings, Scented Stationery. Profits to 100%. Bonus. Request free samples exclusive Name Imprinted and Floral Stationery, free catalog and Feature All-Occasion samples on approval. Special offers. New England Art Publishers, North Abington 203, Mass.

# POPULAR SCIENCE OPPORTUNITIES

FREE Nylons given if Kendex hosiery runs or snags. World's only women's hosiery sold with written guarantee amazing everybody. Mere words could not express unbelievable money making opportunity. Fantastic earnings become reality. Armstrong earned $202 in 9 days. Watkins sent 92 orders in one day. Imagine replacing hosiery free regardless of cause—whether use or abuse! Truly sales dynamite for terrific profits. Even if you never sold before, three magic words: "Guaranteed Against Everything" will open doors for you—make women listen and pour money in your pocket. Nationally advertised in Life, Ladies Home Journal, Saturday Evening Post, McCall's and Woman's Home Companion. Awarded Seal of Approval by Good Housekeeping. 75 million readers will see Kendex advertising to help you make quick sales and big money. Complete line from sheerest 15 denier 51 gauge to heavy 70 denier service. Sizes $8\frac{1}{2}$ to $11\frac{1}{2}$; lengths 28 to 35 inches; latest fashion colors plus white; full fashioned seamed and seamless. No competition because Kendex nylons are not sold in stores. Also complete line men's hosiery actually guaranteed for one full year or replaced free. Nothing like this anywhere. Includes rayon, nylon, lisle, wool, cotton, mixtures, etc. All styles, patterns, colors, prices to please everybody. 200,000 pairs constantly in stock for fast delivery. Thousands shipped daily. Over 30 years in business. You need no money or experience. Nothing to pay now or later. Just show free outfits. Write orders. We deliver and collect. Big advance cash plus huge bonus. Earn money spare or full time—exclusively or as side line. No restrictions. Become manager—appoint others to sell for you—earn steady income on their sales. Man or woman, young or old, experienced or beginner, you can make money and friends writing orders. Everything you need is furnished free, including sales books in color, samples of hosiery materials etc. Simply write your name and address on postcard and make money next week with money-making outfits sent free and prepaid. No obligation. Kendex Company, Babylon 54, New York.

FREE Samples, and amazing plan, giving you Gorgeous Dress without penny cost. Rush name today, with dress size. Harford, Dept. B-335, Cincinnati 25, Ohio.

ABSOLUTELY Free! Big package actual sample fabrics and style presentation of dresses, lingerie, hosiery, etc. Take orders. Commissions big. Send no money. Melville Co., Dept. 5279, Cincinnati 3, Ohio.

MAKE Money Calling on Friends. Show nationally advertised Greeting Card Assortments—16-Card All Occasion Assortment only $1.00—also Birthday Gift Wrapping, Plastics, Imported English Napkins, Floral Stationery, Children's Books, many more! Up to 50c profit on each assortment. Experience unnecessary. Samples on approval. Write Wallace Brown, 225 Fifth Avenue, Dept. H4, New York 10.

BE Renewal Headquarters for all magazines. Handle everything at home. Big profits. No experience—no capital needed. Free Catalog tells how. Write: McGregor Magazine Agency, Dept. 510A, Mount Morris, Ill.

SELL DuPont Nylon Uniforms. Complete line famous exclusive Hoover styled nylon uniforms for beauty shops, Nurses, doctors, Waitresses, others. Best quality, splendid values. Exceptional income. Real future. Equipment free. Write fully. Hoover, Dept. B-102, New York 11, N. Y.

FREE Samples. Big profits showing amazing Glow-In-The-Dark Specialties, House numbers, pictures, plastic novelties, ashtrays, keyholders, religious and nursery objects, etc. Madison Plastics, 303 Fourth Ave., New York 10, N. Y.

EXCELLENT Sideline for printing and advertising salesmen. Decalcomania name plates in small quantities. Great demand. Also make money with our line of Automobile Initials and Sign Letters. Free Samples. "Ralco", XL-Roxbury, Boston 19, Mass.

MORE money—so easy! Sell distinctive new greeting cards, stationery. Fast selling Plastic Metallic 3-dimension, 21-card $1.00 All-Occasion assortments. Profits to 100%. Exclusive Gift Wraps. Novel "double" cards. Animated Books. Gifts. Bonus. Special offers. Write for free samples exclusive Name Imprinted Decorated Stationery and feature All-Occasion samples on approval. Elmira Greeting Card Co., 2210 Elmira, New York.

NEW! Stainless steel window guard. Foils prowlers! Literature, samples: $1. ArtwareCorporation, 11110 Ventura Blvd., North Hollywood, California.

START Your Own Business on Credit. Always your own boss. 1554 Dealers, sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. B-U-PSC, Freeport, Ill.

FREE! Big box actual full-size packages groceries, home needs, sent Free F.O.B. factory. Try them at home and show friends. World-beating money-making opportunity. Write Zanol, Dept. 8091-B, Richmond St., Cincinnati 3, Ohio.

BIG Bargains for Big profits. Over 100 sensational values. Men's used suits $2, pants 35c, topcoats $1.25, overcoats $2, shoes 20c. Experience unnecessary. Free wholesale catalog. Superior, 1250-B Jefferson, Chicago 7.

NOW we are positive! Pro-Check-Tor—the $3.95 check protector designed for everyone will be the sensation of 1950. You can make thousands. 23,000,000 waiting prospects. Don't pass up this opportunity. Federal Pro-Check-Tor Co., 627-D Grove, Evanston, Ill.

EXTRA Money! Sell new, different greeting cards. Complete line includes Regal Plastic assortment, metallics, "Stand-Up" and "double" cards. Free samples Exclusive Imprinted and Engraved Stationery. Sales Kit on approval. Regal Greetings, Dept. PS-12, Hazel Park, Mich.

ENJOY earning $85.00 weekly selling shoes direct. Experience unnecessary. No investment. Advance commissions. Bonus. Free outfit. Samples. Paragon Shoes, 738 Columbus, Boston, Mass.

AGENTS. Sell finest food products direct to homes. Successfully sold for 25 years. Big profits. Powerful combination sale plans make sales easy. Permanent repeat business. Powerful premiums and free door openers for easier sales. Samples furnished. Live territories open to distributors. Mother Hubbard Products Co., 4139 Grand, Dept. S-Z, Chicago.

NEW "Sponge" Wall Cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 143, Akron, Ohio.

STRANGE "Dry" Window Cleaner. Sells like wild. Replaces messy rags, liquids. Simply glide over glass. Samples sent on trial. Kristee 144, Akron, Ohio.

BE first! Sell this sensational new assortment. Contains everything but the food . . . The invitations, table cover, napkins, nut baskets, place cards, snapper hats, cups, plates, game booklet and six different games; a complete party for eight. Sample $1.25. Also America's leading greeting card line featuring personalized stationery, napkins, book matches and exclusive new Wedding invitations. Free Samples. Elmcraft Chicago, 5930 S. Western, Chicago 36, Illinois.

EXCLUSIVE Agency. Power Mowers—$49.50. Delivered. Modern. 7401-PS, North Kansas City, Mo.

SELL ultra-blue stock signs to stores. 1000 slogans, comedy, general, religious. "7x11" cost 6c—Sells 35c—Make money. 15 samples. Ultra-blue signs "7x11"—$1.00 postpaid. L. Lowy, 8 West Broadway, Dept. 324, New York City.

YOU positively sell our Business Cards By Mail. Successful "Beginners" plan gets you lifetime repeat mail orders, free details. Lynn, 5710-C Bankfield, Culver City, California.

LOOK! Make money all year round selling personal initialed individualized belts, buckles, cap badges, tie holders, complete line Police and Firemen's Badges. 2000 emblems to choose. Big profits, whole or part time. Please write today special outfit offer. Hook-Fast Specialties, Box 1425, Dept. 7, Providence, R. I. Established 1926.

DOUBLE Your Income—Sell wool and Cotton uniforms, Badges, Initial Buckles, Belts, etc. Write Hook-Fast, Box 480PS, Roanoke, Virginia.

SELL Big Money-Maker to men and Women. Easy handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

SELL Slot Machines, Games, Home Bars. Send for wholesale deal. Webb Distributing Co., 4958 West Chicago Ave., Chicago 51, Ill.

$1 starts you in business. Sell top quality $1.00 ties. Now only $7.20 dozen, your profit $4.80 dozen. Regular $1.50 up values. Send $1.00 for Introductory Offer two ties. Catalog complete line free. Philip's Neckwear, 20 West 22nd St., Dept. F-39, New York 10, New York.

MEXICAN feather pictures. Big Profits! No investment! Details, sample, 10c stamps. Sylvias, Apartado 9036, Mexico City.

MAKE $50 selling America's leading All-Occasion greeting card assortments. Samples on approval. Complete line fast money makers—free samples imprinted and monogrammed Stationery, Napkins and Guest Towels. Write Lorain Art Studios, Dept. AP, Vermilion, Ohio.

MAKE money selling all-occasion and plastic cards, Stationery, Wrappings, shopping bags, children's books and phone book covers. $1.00 for samples start you in business. Pascale Greeting Cards, PSJ, Irvington 11, New Jersey.

BUY thousands of nationally advertised products direct from manufacturers and distributors. Write for "Buy Direct and Save". Service Publishing, 218-B Investment Bldg., Pittsburgh 22, Pa.

WOULD you pay 3%—first $350? Book "505 Odd, Successful Enterprises" free! Work Home. Expect something odd! Pacific, Oceanside, Calif.

BIG Profits — amazing safe-Lock (for cars with center opening doors) locks rear doors; children can't fall out. Dollar item sells on sight! Send 50c for sample and details. Safe-Lock, Box 1071-M (PS2), Pasadena, Calif.

SELL new—used clothing from home, auto, store. Men's suits $1.25. Leather Jackets 85c. Overcoats 56c. Dresses 18c. Ladies' coats 38c. Other Bargains. Catalog Free. S&N, 565-G Roosevelt, Chicago.

NOT a get-rich-quick-scheme but honest endeavor can build astonishing profitable business. Every home, factory, institution a genuine prospect. Big repeat orders. Ask for details about Prolac, the miracle finish and protector for wood and metal. Protected territory. Own and develop your own business. Write Widger Products Corporation, Route 5, Alexandria, Virginia.

SELL!! Balloons, Combs, Specialty Merchandise. Carleton House Distributors, Texas City, Texas.

SELL $2 Fire Extinguishers. Locally mailorder. Lorrac Products, Albany 1, N. Y.

FREE Literature—Thousands Wholesale supply sources. Moneymaking Business ideas. Wilkin, Hillsboro 4, Ohio.

EXCELLENT sideline. No selling—easy repeat earnings. Inquire Modern Technical Supply, 55-PS West 42 Street, New York 18.

NEWEST money-making sensation, miniature authentic replicas, police and firemen's badges also pocket pieces, key chains. Write for descriptive folder. Hook-Fast Specialties, Dept. 23, Box 1425, Providence, R. I.

## 63 HIGHGRADE SALESMEN

BIG Money Taking Orders: Shirts, Ties, Sox, Pants, Jackets, Sweaters, Shoes, Uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AV Lincoln, Chicago.

# POPULAR SCIENCE OPPORTUNITIES

SALESMEN, Earn $50.00 weekly, selling only three pairs shoes daily. Commission and bonus. Wide variety for men, women, children. No investment. Experience unnecessary. Free catalog. Tanners Shoes, 560 Boston, Mass.

START your own business on Credit. Always your own boss. 1554 Dealers sold $5,000 to $26,500 in 1948; their average $6,742. We supply stocks, equipment on credit. 200 home necessities. Sales experience not needed to start. Wonderful Opportunity to own pleasant, profitable business backed by world-wide industry. Write Rawleigh Co., Dept. B-U-PSC, Freeport, Ill.

SALESMEN—Sell America's finest, biggest line of Adv. Specialties. Sensational sellers to all types of business. Big commissions advanced. Sensational sales plan nets you top earnings. Free Outfit. Charms & Cain, 407-D South Dearborn, Chicago 5.

"SELL New Automatic Floor Waxer." Trigger on Handle. Hands never touch Floors or Wax. Retails $2.95. Profit 125%. Write Smith, Inc., Greenfield 6, Mass.

SALESMEN—absolutely make $50.00 a day. New sensational utility item for every food, beverage outlet, etc. Samples furnished. Johnson-Hill, 53-B West Jackson, Chicago 4.

RAT-SNAP 35c, 60c, $1.00 Sizes. Also Seeded-Ferto-Soil and Ferto-Pots. Allen Company, Pittstown, N. J.

SALESMEN—Put yourself in line for big money, real future. Keep stores supplied with 5c-10c to $1 counter goods. Nationally advertised. Top profits for you and merchants. Liberal deals boost sales. Sideline or full time. World's Products, Dept. 83-D, Spencer, Ind.

EARN Big Money Fast! Sell finest quality advertising work uniforms to garages, factories, filling stations, etc. Free selling kit. Topps, Dept. B-20, Rochester, Ind.

## 67 EDUCATIONAL AND INSTRUCTION

BE A real estate broker through home study or classroom instruction. Write for free book. Approved for veterans. Weaver School of Real Estate, 15 E. Pershing Rd., Box PC-11, Kansas City 8, Mo.

WANT a steady Big Pay Job in Diesel? Our approved, easy-to-understand Diesel Training Course qualifies you. Placement advisory service Free. Learn as you earn. Write for free 24 page book today! Interstate Training Service, Dept. 2N, Portland 13, Oregon.

HYPNOTISM. Complete course. 20 illustrated lessons $1.00, moneyback guarantee. Baltimore School of Hypnotism, Dept. 23-A, 4214 Belmar Ave., Baltimore 6, Md.

BOOKKEEPERS! Increase your earnings! Operate your own simplified "Dollar-A-Week" Bookkeeping and Tax Service. Full or spare time. Details Free. No obligation. Ellis, Box 203, Cedar Grove, North Carolina.

PIANO Tuning Pays. Learn this profitable profession at home. Our Tonometer and mechanical aids make learning easy. No knowledge music necessary. Diploma granted. Largest and oldest school—51st year. G. I. Approved. Write for booklet. Niles Bryant School, 77 Bryant Bldg., Washington 16, D. C.

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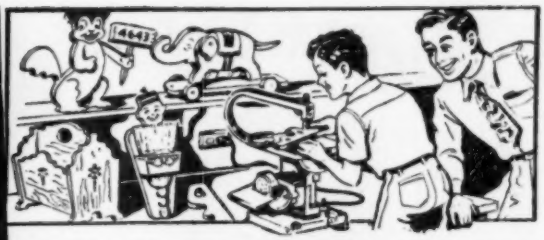

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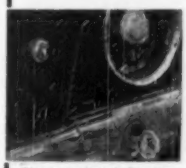

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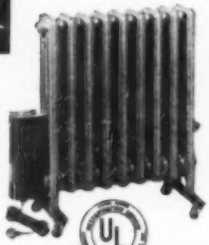

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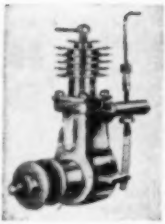

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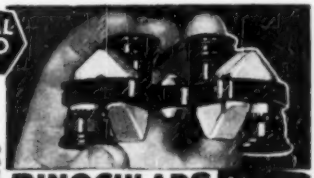

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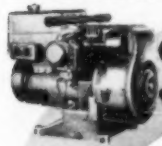

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Pops, plunks, jerks, twitches with full control. Skirt squirms like live bug. Drives bass crazy. Choice 7 colors.

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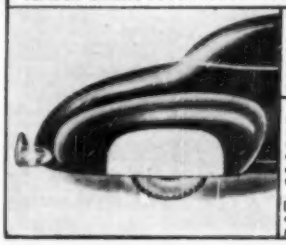

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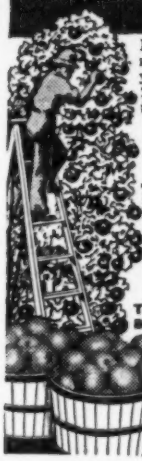

Now—You can grow the world's most amazing Tomato right in your own garden and get from 2 to 3 bushels of delicious, ripe tomatoes from every vine.

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**TRIP-L-CROP**

TOMATO grows 16 to 20 feet high. Huge, meaty, solid fruit, wonderful flavor. Some weigh as much as 2 pounds each. Unsurpassed for canning and slicing. Blight free—drought and disease-resistant. Grows in any garden Outyields all other varieties.

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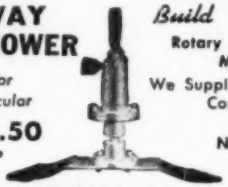

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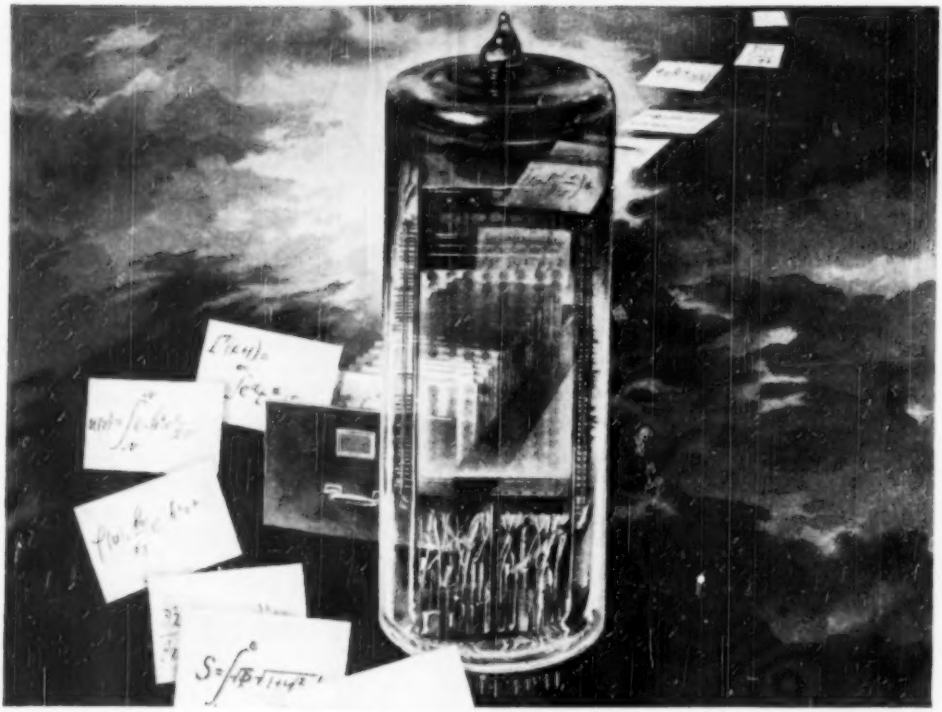

New RCA electron tube gives today's amazing computing machines an indispensable memory.

## ***Tube with a memory*** *keeps answers on file*

So complex are present scientific studies—such as in atomic research—that just working out the "arithmetic" could take all of our scientists' time.

A short cut is found in electronic computers, capable of adding or multiplying numbers as large as one thousand billions in *millionths of a second*. But such speed is valueless unless—with comparable speed—the results of countless computations can be kept "on file" and taken out again.

**Such a "file" now exists in a "memory" tube, developed at RCA Laboratories. Electronically it retains figures fed into calculating machines, holds them in storage while it memorizes new ones—speeds intelligent solutions through mazes of mathematics.**

Uses of RCA's "memory" tube are many. It will help atomic scientists acquire new and needed knowledge . . . provide new information on supersonic flight . . . even help make rapid weather predictions! It is an invaluable instrument in the scientist's campaign to penetrate the unknown.

**For your benefit:**

Development of the "memory" tube is just one example of the many basic advances pioneered at RCA Laboratories. Continued leadership in science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

*Examples of the newest advances in radio, television, and electronics—in action—may be seen at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.*

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# The Playing Fields of Science

THE Battle of Waterloo, they say, was won "on the playing fields of Eton." And the athletic field has long been a training ground for the kind of courage and leadership that is vital in visible combat.

But the battle for survival, it seems obvious, will be won on the playing fields of science and engineering. With or without war, the future that projects from the present calls for aptitudes that don't grow on athletic fields.

For two years, the Civil Service Commission has been looking for the answer to the question that is the hinge of the future: where can we find the thousand young men a year who will be needed to run a billion-dollar-a-year program?

The young men with the aptitudes to dream, develop, and operate equipment constantly more complicated aren't dashing around on high-school football fields. The best place to catch a future physicist, the Commission says, is among those who get through school ahead of schedule.

The best budding engineers and technicians, according to the Commission, come from the high-schoolers who spend their spare time soldering up a radio circuit, or crawling around the innards of an automobile.

In other words, the "playing fields" of science and engineering are the school lab after hours, the Model Garage, and the back room of Joe's Radio & Fixit Shop.

We think that, technically, the future is in good hands.

Perry Githens

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in these truly modern batteries. Each Ray-O-Vac Leak Proof starts with a powerful, well made battery Then . . .

1. **Steel bottom is added.**
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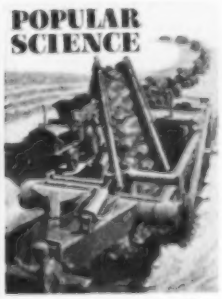
**GUARANTEE** on every Ray-O-Vac Leak Proof: "If your flashlight is damaged by corrosion, leakage or swelling of this battery, send it to us with the batteries and we will give you FREE a new, comparable flashlight with batteries."

*Ask for Ray·O·Vac Leak Proofs*

# Buy Spares ... *they stay fresh*

***Water Trails in the Sky . . .*** This may look like a rocket-assisted take-off. Actually it is a Fairchild C-119 Packet cargo plane dumping water ballast during a test flight. Replacing 25-pound bags of shot used previously as ballast, the water, contained in four 720-gallon aluminum tanks, can be pumped back and forth to duplicate any load distribution. The water ballast is transferred from tank to tank at the rate of 70 gallons a minute. Electrically operated valves in each tank permit the entire liquid load to be jettisoned through 10-inch openings in the plane's floor in 75 seconds.

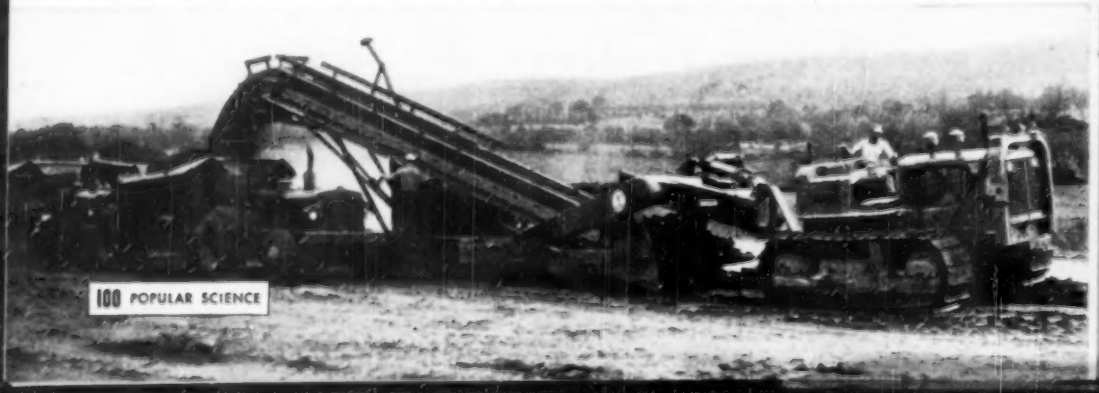
**Big mouth of this earth mover can scoop up a ton of dirt a second in a 9½-foot-wide swath.**




*Cover painting by Ray Pioch*

# Big Mouth Eats a Ton a Second

**Trucks follow loader** in long procession, each one moving up under the conveyer as the one ahead is filled and moves on. The loader can fill the trucks, each with a 16-cubic-yard capacity, at a rate of better than one a minute. All out, it can dig a ton a second. The loader itself, not including tractor that pulls it, is 50 feet long and 18 feet high. Conveyer is 4½ feet wide.



***Machines that move mountains are helping man literally to change the face of the earth.***

**By George H. Waltz, Jr.**

*PS photos by Hubert Luckett*

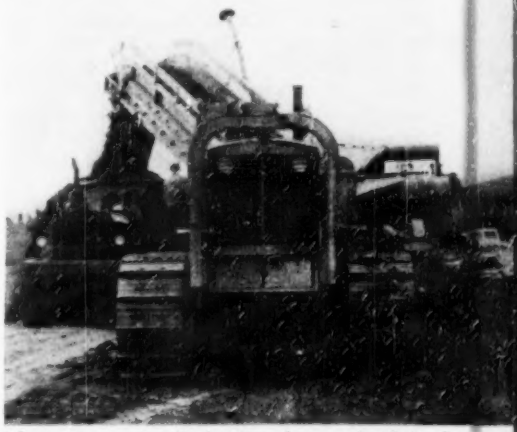
A HALF-DOZEN years ago, a dam or road builder who could handle 300,000 cubic yards of dirt a day was considered a miracle man. Now, more than one large contractor can guarantee to move 1,000,000 cubic yards—the equivalent of a mountain of earth half as tall as the Washington Monument and a seventh of a mile long at its base—in a day without even straining his equipment!

This tremendous increase in our ability to make mole hills out of mountains is made possible by the new and ingenious "big mouths" used in the earth-moving industry. Today, we have mechanical monsters capable of chewing up and transporting prodigious amounts of dirt. We have rugged Diesel engines capable of powering such earth movers. And we have mammoth rubber tires—some taller than a man and costing more than your family car—on which the new earth movers can roll at high speeds.

Right now, a team of one breed of "big mouths"—giant-size conveyer-belt loaders—is chewing through the hills and dales near the town of King of Prussia, Pa., to form the roadbed for the eastern extension of the famous Pennsylvania Turnpike. A few weeks ago, I watched one as it spewed an almost continuous stream of earth into big Diesel-powered trailer trucks, each capable of holding enough dirt to fill the average living room up to its door tops.

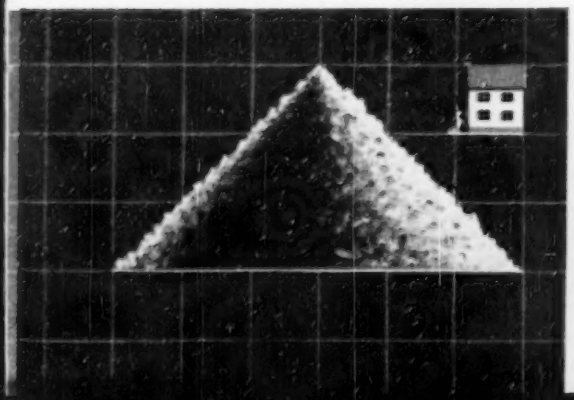
Stopwatch in hand, I timed the opera-

**Close-up of big mouth** in action shows how dirt sheared off by large, plowlike blade and edge-cutting blade at side is funneled into 35-foot-long rubber conveyer that feeds it to trucks.



**Above, tractor pulls loader** along at brisk 3-m.p.h. pace when cutting. Note the depth of the cut as shown by the high bank at the right. Below, a General Motors Diesel mounted on the rear end of the loader powers the conveyer. Tiny figure of truck driver shows giant's size.

**Mountain a day.** In 24 hours, as drawing below shows, loader can move enough dirt to form hill three times taller than average two-story house and six times wider in diameter at the base.



**The tractor driver** controls the loader with three hydraulic levers mounted just behind his seat. The levers control the movement of the conveyer belt, the angle of the cut, and the depth of the cut. Looking back, the tractor driver gets directions signaled to him from man on rear end of loader who also signals directions to drivers of trucks moving up under conveyer.

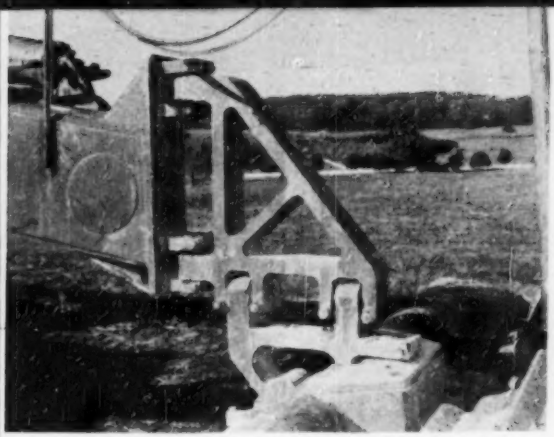
tion as a long procession of the deep-bellied trucks followed the loader as it gouged out the roadbed at a three-mile-an-hour clip. As each truck was filled to heaping, the one directly behind it would pull up under the loader's conveyer and follow at the loader's pace. It took just 50 seconds, on the average, to fill a truck to overflowing and get it on its way.

The big-mouthed loader was gulping up dirt at better than 16 cubic yards a minute, or at a rate of 23,000 cubic yards every 24 hours. If its round-the-clock output were piled in one spot, it could form a hill three times taller than the average two-story house and six times larger in diameter at the base. If it were dumped into a block-long city street, it would bury it up to the third-story window sills of the bordering buildings. At the time, the loader was running at less than full speed. All out, the conveyer can deliver as much as a ton a second. That's 36,000 tons in a 10-hour shift.

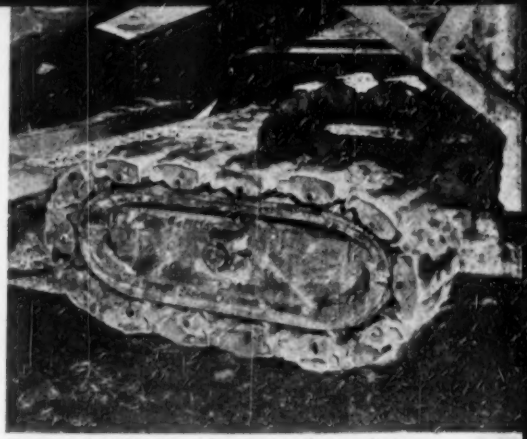
### *Mountain a Day*

In any terms of comparative measurement, that single machine was moving a heap of dirt. Little wonder then that, by putting to work a large number of "big mouths" like the one I was watching, a well-equipped contractor can literally move a mountain a day!

**Another big mouth,** this new twin-engine scraper has one engine in front to pull and another in back to push. Fully loaded, it weighs 122,000 pounds, yet can still scoot over rough ground during hauling runs at 30 m.p.h. It can make a round trip from "borrow pit," where it picks up needed dirt, to the dump point several hundred yards away in less than 3 minutes.



**Special bridgelike design** of hitch and drawbar centers loader's 25-ton weight on tractor's track frames. Joint's universal action lets loader pitch and yaw without straining coupling.



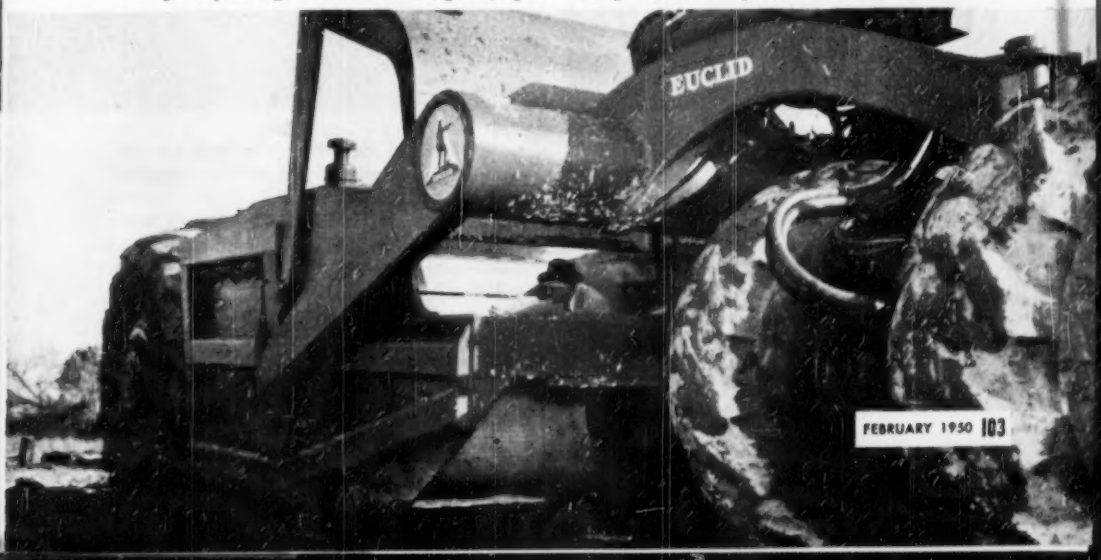
**Rear end of loader** rides on crawler tracks having individual rollers on each shoe. Tracks spread weight over large area, providing good flotation and stability on soft or uneven ground.

Basically, the loader is an overgrown, super-powered belt conveyer riding on twin endless tracks and fitted with a wide cutting blade and deep plow at its forward and lower end. Its 50-foot length and 18-foot height dwarf the tractor that is used to pull it along.

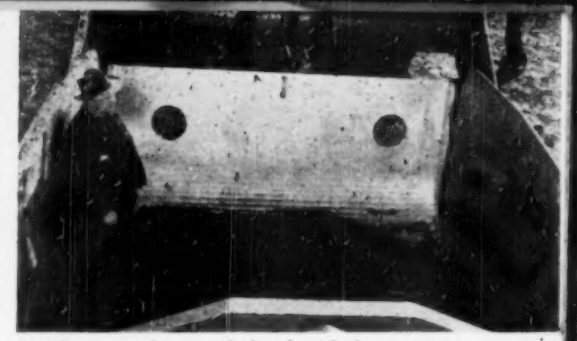
As the loader moves forward, the plow mouth, which can cut a swath nine and a half feet wide, feeds a steady stream of dirt onto a rubber conveyer belt that is four and a half feet wide. At the end of its 35-foot trip up the conveyer, the dirt is dumped into the waiting trucks. A 190-hp. Diesel engine, mounted on the rear of the loader, provides the power for the belt conveyer. The movement of the belt, as well as the angle and the depth of the cut, all are easily controlled by the tractor driver through three conveniently located hydraulic levers mounted just behind his seat.

As he drives, he looks back and receives hand-signaled instructions from the "truck guider" who stands on the loader's frame just under the upper end of the conveyer. The "guider" watches the loading of each truck and not only signals to the tractor driver when to start and stop the belt but indicates to each truck driver whether he should pull up or fall back to distribute the dirt evenly in the truck's body. The efficient operation of a loader depends to a ▶

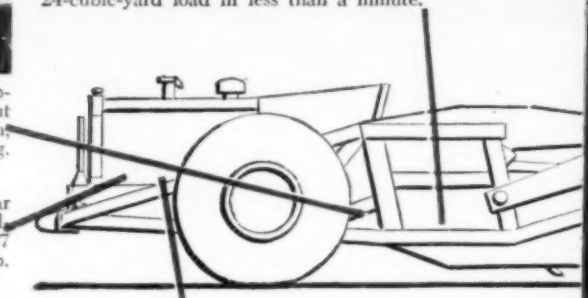
**Ground's-eye view** shows scraper's giant bowl. Man in center is dwarfed by its massive size. When scraping edge (lower foreground) has scooped up enough dirt to fill bowl, gate (top of picture) is lowered, and bowl is raised clear of ground for overland travel. Note sharp, near-90° angle of front driving wheels, permitting the scraper to turn on proverbial dime.



**To dump scraper,** gate is raised, and telescoping hydraulic piston tips up bowl to spill out dirt. Dumps, like pick-ups, are made on the run, so entire operation is done without stopping.



**Inside view** of scraper's bowl with front gate closed shows its large capacity. Sides are as tall as man standing inside. Scraper can pick up its 24-cubic-yard load in less than a minute.



**A 190-hp. GM Diesel** powers scraper's rear wheels through Allison torque converter. Goodyear tires, 87 in. in diameter, each weigh 1,427 lb., cost $2,400, and take ½ hr. to inflate to 40 lb.

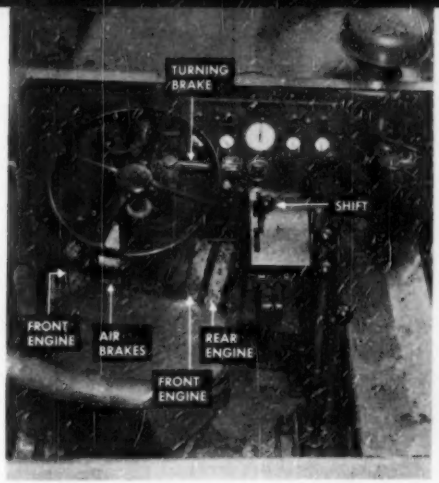
**Four solenoids,** below, automatically shift the scraper's rear-engine transmission when the operator shifts the front engine. Both engines have three speeds forward and one in reverse.

large extent on the teamwork of these three men.

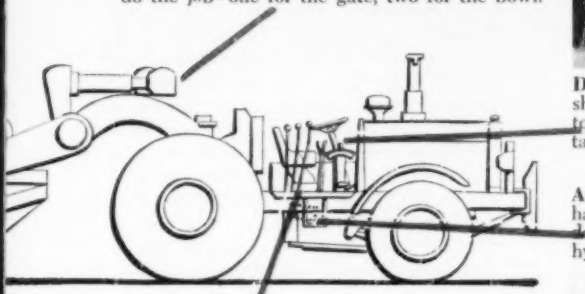
Newest of the "big mouths" that are now speeding the construction of dams and highways is the twin-engined scraper. Manufactured by the Euclid Road Machinery Co., of Cleveland, Ohio, which also makes the loaders I saw in operation, the new earth mover not only loads itself by scraping earth up into its belly at the rate of 24 cubic yards a trip, but it carts its load quickly to where it is needed. It can gather in its full capacity of dirt in less than a minute and be off on its overland haul to the dumping area at a galloping 30-m.p.h. pace.

Pan scrapers are not new in the earth-moving business. Those in general use, however, are of much smaller capacity (14 cubic yards or less), are pulled by a tractor or a two-wheeled traction unit, and normally require a second tractor or 'dozer to push from behind while they are making a cut to fill their bodies. On the overland haul after loading, their speed is limited.

**Gate and bowl,** like unloading ejector, are hydraulically operated. Three cylinders atop the front end of the scraper body, as shown above, do the job—one for the gate, two for the bowl.

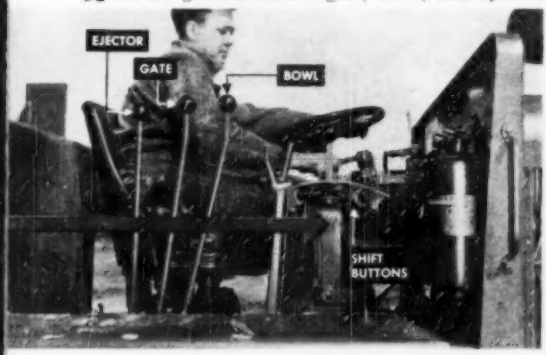


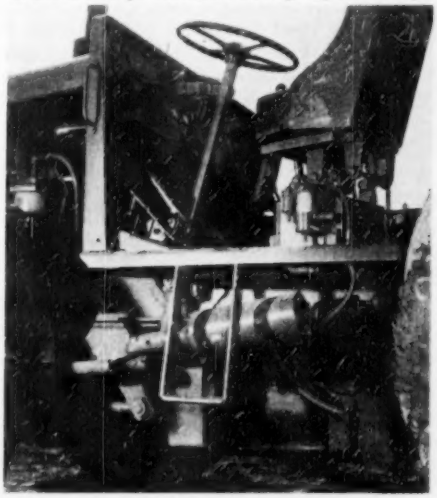

**Driver's cockpit** has more pedals than you can shake a foot at. Pressed together, dual accelerators at right control front and rear engines simultaneously. Larger pedal at left is air brake.



**When driver shifts front engine,** roller attached to shift lever operates buttons that actuate solenoids to shift rear engine. Three levers in foreground control gate, bowl, and ejector.

**Air booster** on steering mechanism lets driver handle the big machine about as easily as you do the family car. The seat is equipped with hydraulic shock absorbers and spring mountings.



Not so with the new twin-engine scraper. It has its rear-end pushing power built-in in the form of a remotely controlled Diesel engine that drives the rear wheels through a torque converter. The 190-hp. Diesel that powers the two rear wheels of the front-end puller is used for general maneuvering. When power from the rear of the scraper is needed in making a cut, however, the operator presses down on dual accelerators to bring both engines into play. This applies a total of 380 horsepower from the two engines to the four giant rubber driving wheels.

The new scraper makes scraping and loading a one-man operation. When the driver shifts gears on the front engine, the gear-shift lever operates buttons that in turn activate solenoids to shift the rear engine simultaneously. The effort necessary to steer the 48-foot behemoth, which weighs approximately 122,000 pounds fully loaded, is no more than that required to drive the average car. An air booster on the steering system takes care of that. As for

brakes, a foot pedal applies air brakes to all four driving wheels, while an auxiliary hand-operated air brake allows the driver to lock either the right or left front driving wheel as an aid in making sharp, right-angle turns. Even the horn is air-operated.

By operating three levers located at his right, the driver has fingertip control of all scraping (loading) and dumping operations. He can lower the pan to scrape and load or raise it to carry. He can open or close the front gate. And he can control the ejector that pushes the dirt out during the unloading operation. In each case, powerful hydraulic plungers provide the lifting, opening, closing, or pushing power.

### *Working on the Run*

Under average conditions, the twin-engined scraper can work continuously without stopping. When a cut is to be made, the bowl, or body of the scraper, is lowered so that its front cutting edge can take its long scooping bite of earth under the power of the four big driving wheels. Then, when the bowl is filled, its front edge is raised, the gate is closed, and the scraper is off at a good clip to the dumping or fill-in grounds. To unload, the driver simply moves the controls to open the gate and move the ejector forward. The dirt spreads out evenly from the forward edge of the raised bowl and the scraper starts its trip back for another cut. On the average overland haul —about 400 or 500 yards—the entire sequence from loading to dumping and back to loading takes less than 3 minutes.

Power, capacity, and speed—those are the watchwords where earth movers are concerned. For they are the three factors that reduce costs and speed construction. And all three are made possible through the development of the Diesel and giant rubber tires.

Visit any big construction job today and you'll see the strongest, the biggest, and the fastest, all the way from the loaders and scrapers to twin-engined Diesel dump trucks that can roll over rough off-the-road terrain with a full 34-ton payload at better than 25 m.p.h.

Watching these machines move mountains, you have to think twice to realize that they are today's version of the dinky mule-drawn "fresno" wagons that not long ago toted the dirt for our roads and dams and even today still help out with the daily chores on many a small farm. END

## *Automatic 'Chute Safeguards Airmen*

THE British airman below is wearing the latest addition to pilots' safety devices—a parachute with a robot ripcord. The automatic release assures that even a wounded or unconscious jumper's 'chute will open at a preset height from the ground. It also delays opening of the 'chute until a jumper has fallen quickly through high-altitude air so rare that he might suffocate. The release works by barometric pressure on the rubber bulb seen attached to the mechanism on his belt. If a flier abandons his aircraft below the altitude for which the release is set, a clockworks opens the 'chute after a delay of five seconds to make sure he is clear of the plane. The robot release, developed by the Irving Parachute Co., of Hertfordshire, England, operates a seat-type 'chute; the chest 'chute here is worn only for emergency use.

## What Makes the Water Run?

SPECTATORS were stumped at a science show staged by the Naval Ordnance Laboratory in White Oak, Md.—a faucet hanging in mid-air kept spewing forth water. The explanation: the stream hid a glass tube connecting the faucet with a big pan on a table. A motor pumped water up through the tube, and it ran down the outside.

## Sander Helps Tires Grip Road

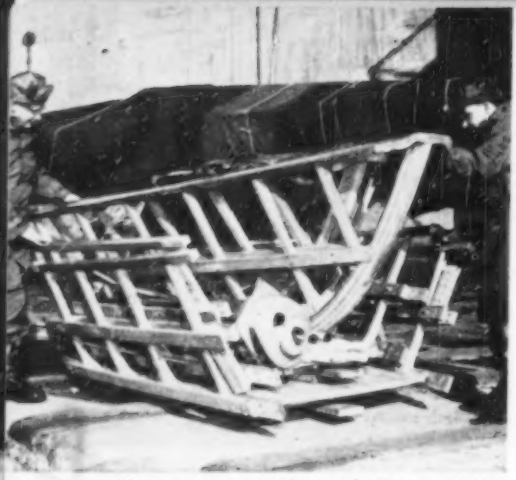
THIS road-sanding unit on a new General Motors truck is operated by a dash-controlled solenoid when tires need more friction. Made by the Elston Electric Sander Co., St. Paul, it holds 70 lb. of sand.

## 'Copter Nose Peels Open

OPENING like orange peels, the doors on the nose of this new Air Force helicopter, made by Sikorsky, give ready access to the engine and the big fan necessary to cool it. With seats for 12 or space for eight stretchers, the machine has been flight-tested successfully. The cabin is under the main rotor. The pilots sit above and forward of it.

## Jack Speeds Car Loading

AUTOMOBILES are pushed from assembly lines right into waiting freight cars with this new Autow Loader® made by the Salsbury Corp., of Los Angeles. The tug in the foreground lifts the rear end of an automobile with a hydraulic jack and pushes it into the rail car. An assistant at the steering wheel guides the car's front wheels.



1 **Nested sections** of Army's Transportation Corps umiak are examined by two soldiers from Fort Banks, Mass. Boat was designed by Corps' Marine Section at Brooklyn Army Base.

# *Army Improves Eskimo Boat*

THE Army's Transportation Corps has taken apart an age-old Eskimo boat, the umiak, and put it together again better.

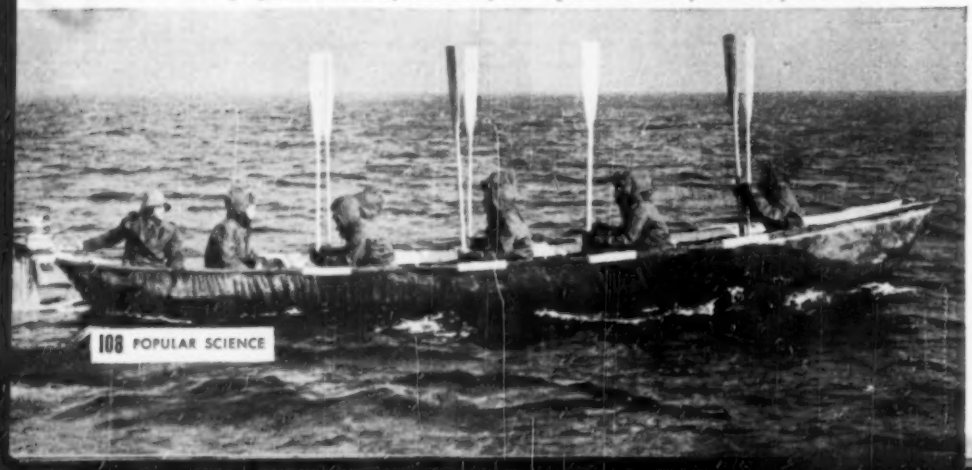
The umiak is a light, small craft with a wood framework covered with animal skin. The Eskimos, propelling it by paddle, find it ideal for Arctic use.

The new Army version is collapsible. It comes in four wood-framework sections that are fastened together and covered with a rubber-impregnated nylon skin. That makes it portable for long overland hauls. And it can be dropped—in pieces—from an airplane.

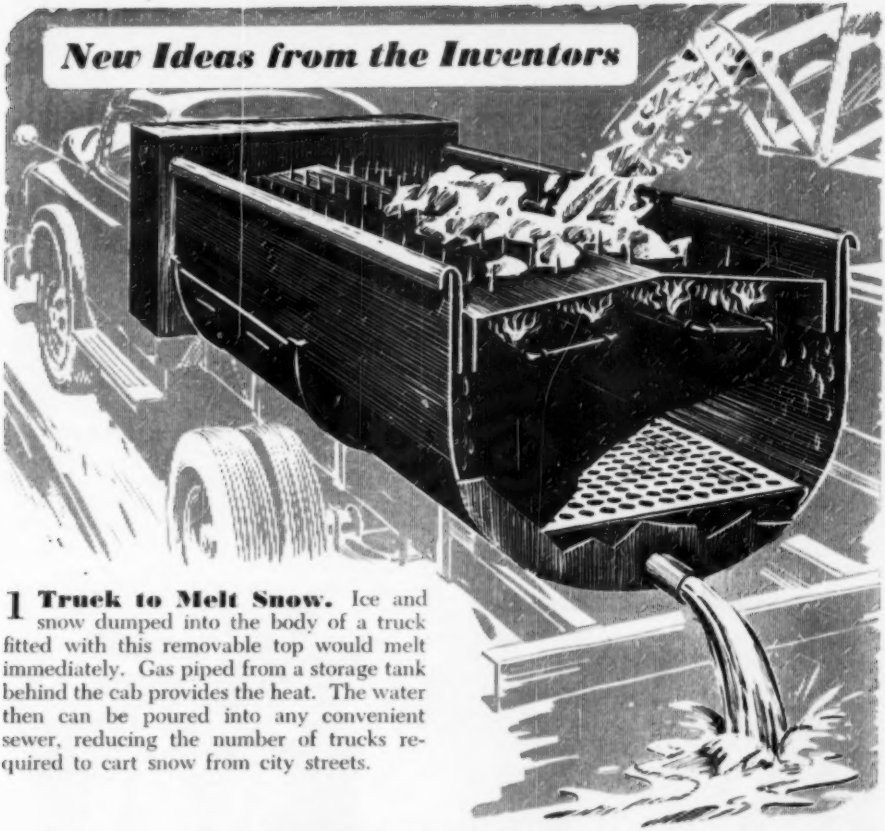
2 **Eight soldiers prepare** to assemble the sections. Boat, 26 feet long, can carry 11 men or 3,000-lb. cargo. Weighing 500 lb., of which 440 is frame, it can breast fairly rough seas.

3 **When sections** are bolted together, skin is slipped on. Lashing draws it tight and secures it. Boat was constructed on dory-type lines at Graves boat yard, Marblehead, Mass.

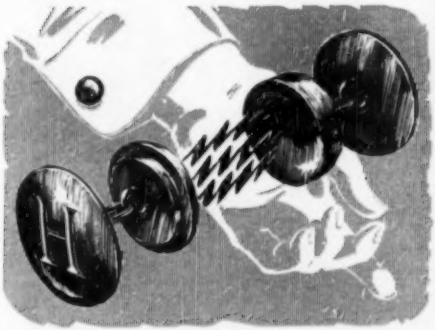
4 **Here craft rides** icy waters off Marblehead. It can be propelled either by oar or by a 10-hp. outboard motor, which gives it 8-m.p.h. speed. Assembly took only 30 minutes.



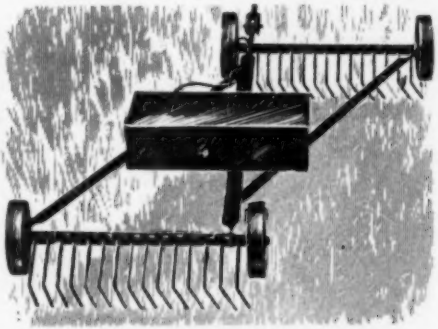
# New Ideas from the Inventors



**1 Truck to Melt Snow.** Ice and snow dumped into the body of a truck fitted with this removable top would melt immediately. Gas piped from a storage tank behind the cab provides the heat. The water then can be poured into any convenient sewer, reducing the number of trucks required to cart snow from city streets.



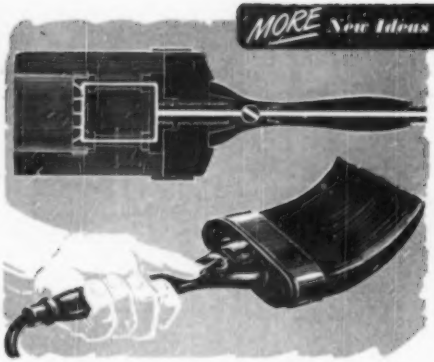
**2 Magnets to Hold Cuff Links.** There would be no fumbling with the fastenings of these cuff links. A powerful magnet embedded in one half of each link and a soft iron disk embedded in the other form a strong "magnetic latch" to hold them together. The design concentrates the magnetic force so it won't magnetize a wrist watch.



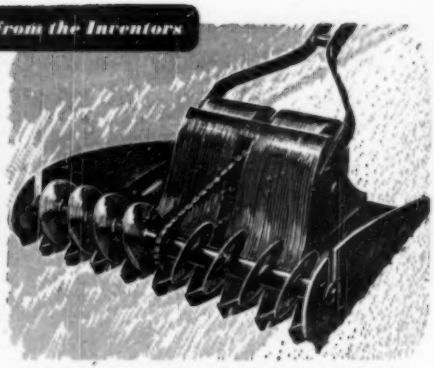
**3 Electricity to Kill Weeds.** Weeds would be literally shocked to death when this electrical weed killer was pulled over them by a tractor. Multiple electrodes projecting down from the wheeled trailer touch the weed shoots and give them a 12,500-volt-AC jolt that, according to the inventor, will effectively kill their roots.

*Turn the page, please, for three more new ideas*

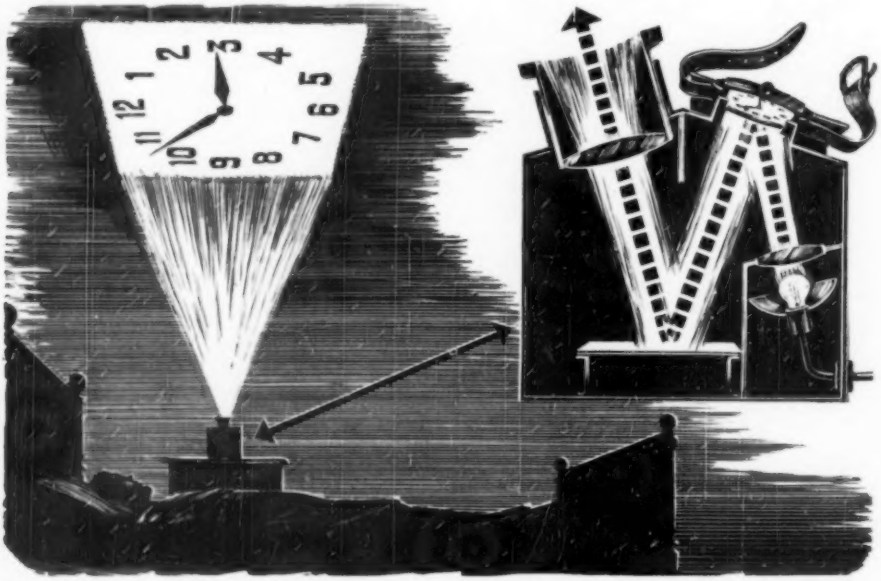
## MORE New Ideas from the Inventors



**4 Brush to Speed Painting.** Bothersome dipping in a paint can would be out with this brush that is fed by a flexible tube connected to a paint reservoir. The flow of paint to the bristles can be controlled by a handy thumb-operated valve. For ease in cleaning, the brush handle, bristles, and paint feeder can be easily taken apart.

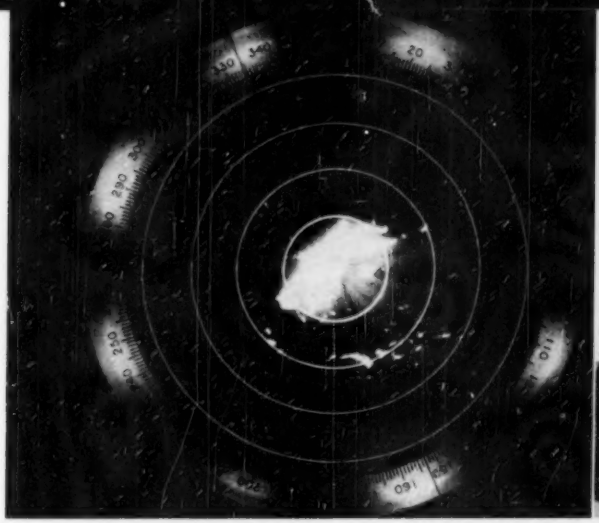


**5 Mower to Use Disk Cutters.** A set of rotating elliptical disks would replace the conventional long cutting blades on this lawnmower. Mounted on the driving shaft at an angle, each rotating blade produces a shearing action first against one edge and then the other of a V-shaped tooth. Mower operates when pulled or pushed.



**6 Projector to Show Time.** You wouldn't need even to lift your head from your pillow to see the time at night with this projector. A push of a convenient bedside switch flashes an image of the dial of your watch on the ceiling. Before retiring it is necessary only to place your pocket or wrist watch on an aperture on top of the projector housing. A small lamp bulb, two lenses, and two reflectors do the rest when the switch is operated. The projector also can be arranged to project onto a wall.

*Patents on these inventions have been granted to: 1. A. J. Cayas, Glendale, Calif.; 2. H. Avedon, New York, N. Y.; 3. G. M. Baker, Los Angeles, Calif.; 4. R. S. Kisner, Red Bank, N. J.; 5. W. Brauer, Ingleside, Tex.; 6. S. Loewe and B. Lowe, Yonkers, N. Y.*



## Sensitive Radar Snoops Out Storms in Advance

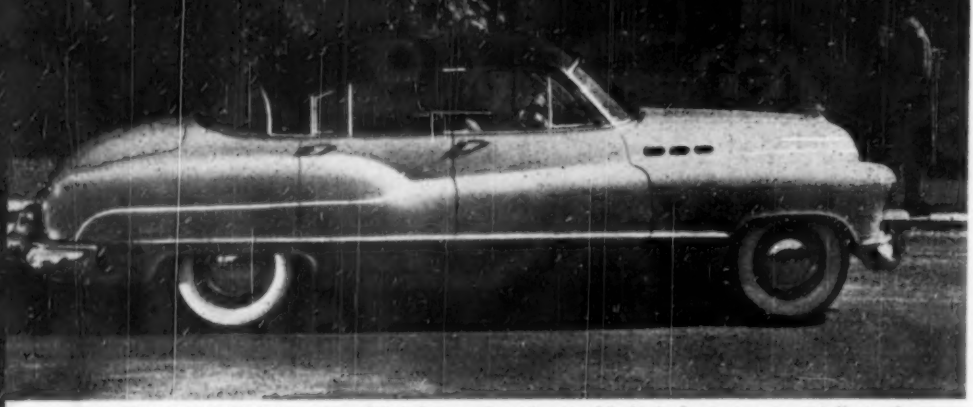
THE U. S. Signal Corps Engineering Laboratories at Ft. Monmouth, N. J., is forecasting storms by radar six to eight hours away. In the picture of the oscilloscope above, the top represents due north. The hard blotch of light in the center, site of the station, is made by nearby land and sea targets. The flecks of light within the rings, spaced at 100-mile intervals, are storms from 175 to 275 miles away. Broken light on perimeter is degree scale. Picture at right shows 100-foot storm-detector tower.

### Fancy Towboat Has Radar

THIS ultramodern towboat can pull three integrated barges with a capacity of 81,680 barrels of gasoline. It's equipped with radar, radiotelephone, and an automatic pilot. Made for the Sohio Petroleum Co., it is powered by a pair of two-cycle General Motors Diesels of 1,600 hp. each.

### 'Chute Stops Newest Bomber

TO SAVE brakes and permit use of shorter fields, the newest U. S. bomber, the Air Force three-jet XB-51, can be brought to a fast stop at the pilot's discretion by a ribbon parachute released from above the tailpipe. Main wheels are bicycle style; plane is steadied during taxiing by wing-tip wheels.



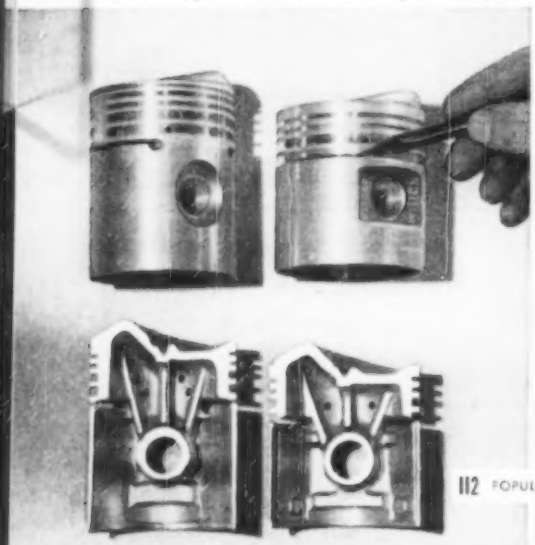
**Buick's sleek 1950 Super model 4-door sedan shows added window area, especially in the rear.**

# Buick Boosts Power, Engine Compression

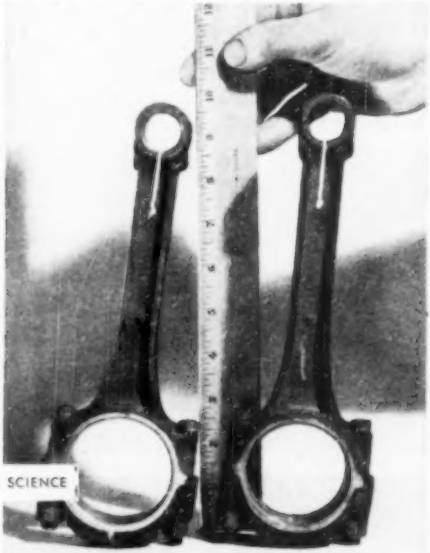
BUICK unveiled 21 new models at the turn of the new year—with higher compression ratios and resulting higher horsepower. The company's stable of cars boasts seven models for each of its three lines—Roadmasters, Supers, and Specials. The compression ratio for all Dynaflow models has been boosted from 6.9 to 1 to 7.2 to 1. Horsepower ratings are: Roadmaster, 152; Super, 128; and Special, 122. A slight increase in compression ratios for Buicks with standard transmissions also was announced.

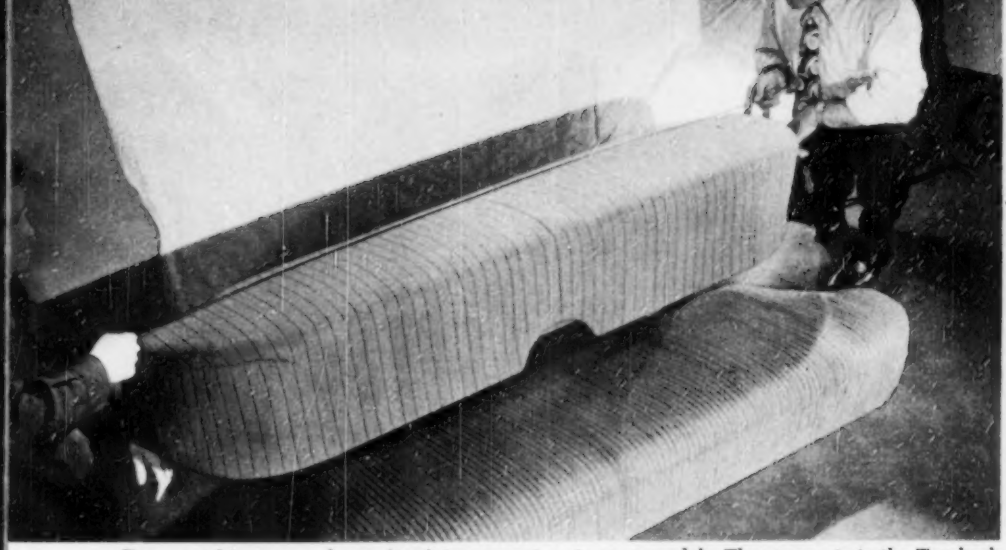
Aside from many small engineering refinements, the company's chief accomplishment for 1950 is a new engine for its Supers. It's more powerful without the penalty of a weight increase and, due to a new rear-axle ratio, uses less fuel in normal driving. The compression ratio is 6.9 to 1 with the regular transmission.

**Super's new pistons** (right below, with older one) are cut 9/16 in. in length to 3 49/64 in. Bore is boosted 3/32 to 3 3/16 in. Pencil points to new type of slot to minimize piston slap.



**Con rods are ¼ in. shorter,** or 7⅞ in. between bearing centers. Stroke remains the same. Power of engine on Super models has been upped to 128 hp. from 120 hp. without weight increase.





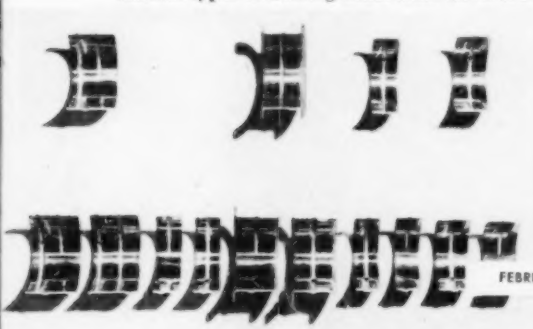
**Rear-seat hip room,** shown (top) in comparison with last year's, is greater—up to 14½ inches in some models. The rear seats in the Tourback models are roomier than the front ones.

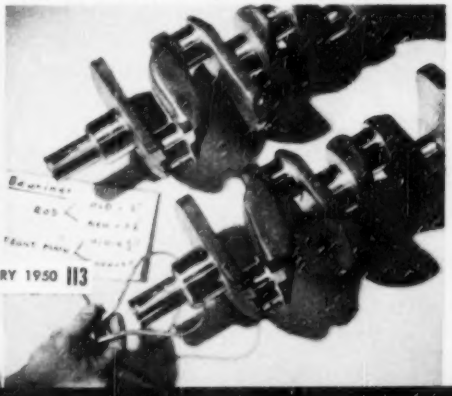
**A contribution to quietness** as well as protection of luggage is hair flocking of rear compartment with spray gun. This simulated-cloth covering is good for lifetime of the automobile.

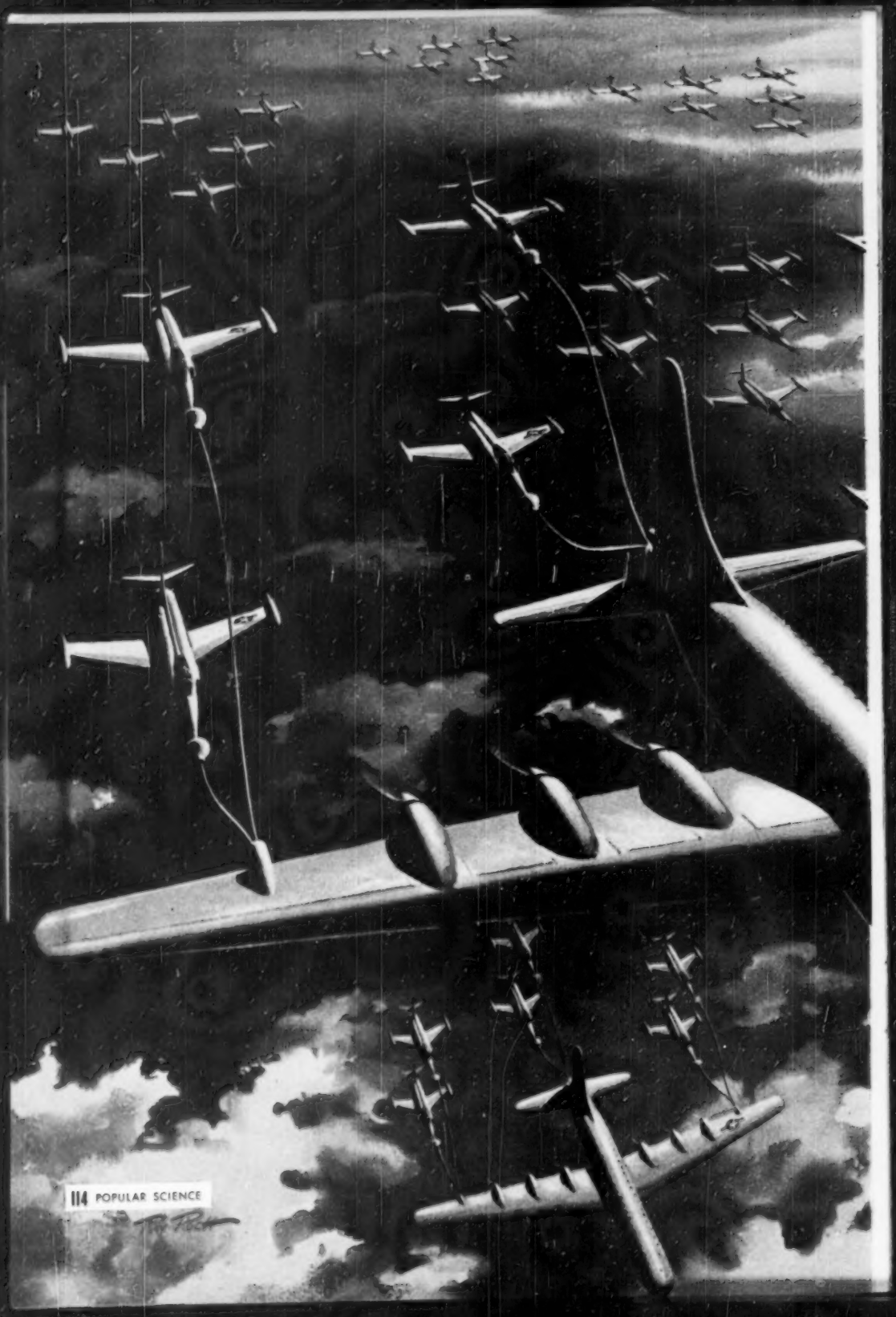
**This is the hair flocking** as it looks after application. Counterbalanced springs eliminate former lid braces and save space. Turn of key opens lid; locking handle is gone.

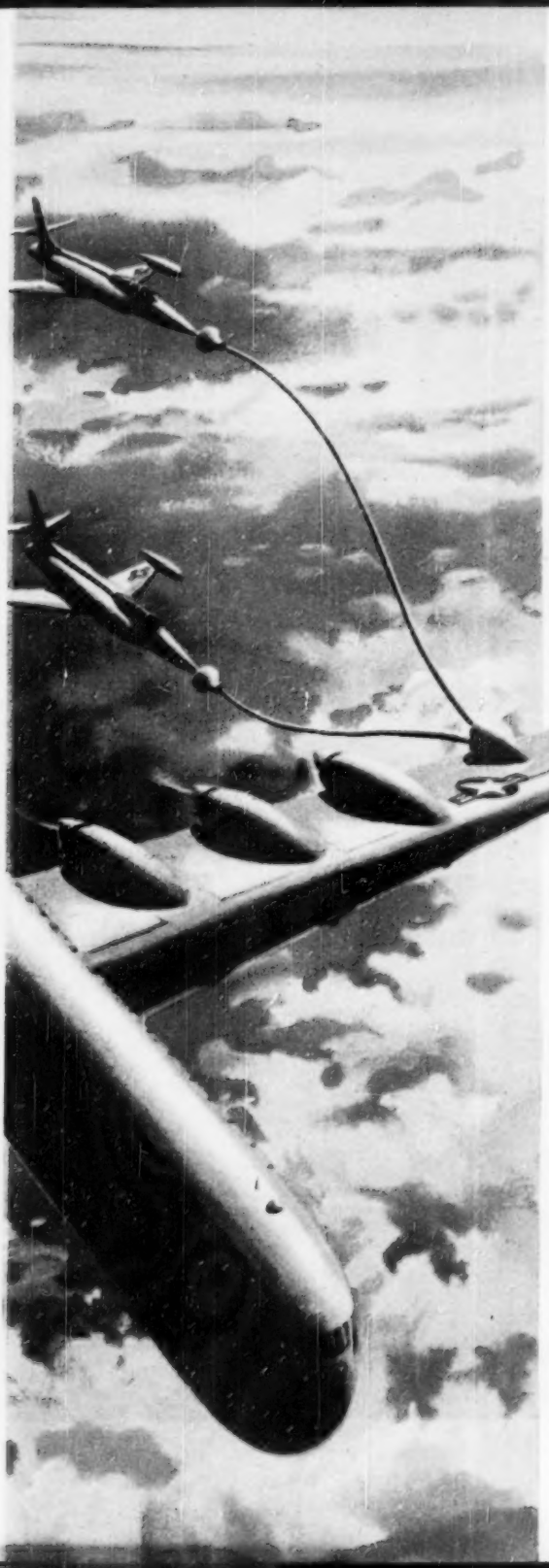
**Bearing journals** on Super engine crankshaft have uniform diameter of 2 9/16 in. in place of five different diameters formerly used. This reduces types of bearing shells from 10 to four.

**Main-bearing diameter** on Super has been boosted ¼ in. to 2 9/16. and rod-bearing diameter ⅜ in. to 2⅜. Engine displacement is 263 cubic inches. Crankcase height is slightly less.









# Air Tankers Fuel Jets for Long Flights

**Speedy new system for refueling on the wing opens way for revised air strategy and faster airline trips.**

***By Devon Francis***
*Drawings by Ray Pioch*

IT LEAKED out last month that the U. S. Air Force had three Republic Thunderjet fighter planes equipped to be completely refueled in mid-air in 90 seconds each—and the way was opened for a fundamental revision in the nation's air defense strategy.

The perfection of a quick in-flight refueling system also promised seven-hour transatlantic schedules by jet-propelled passenger transports, perhaps within a year.

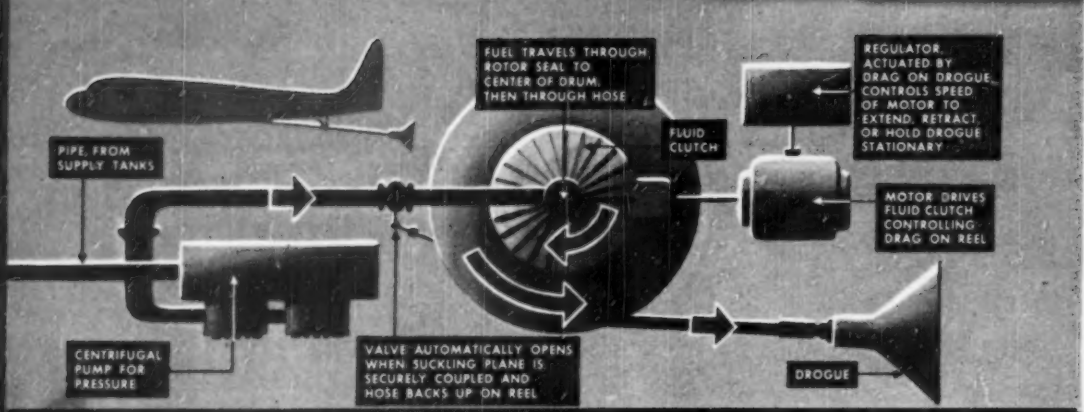
It forecast the probability of ultimate five-hour passenger flights coast-to-coast in jet-propelled aircraft.

It offered the U. S. Navy new versatility and striking power for its carrier fleet.

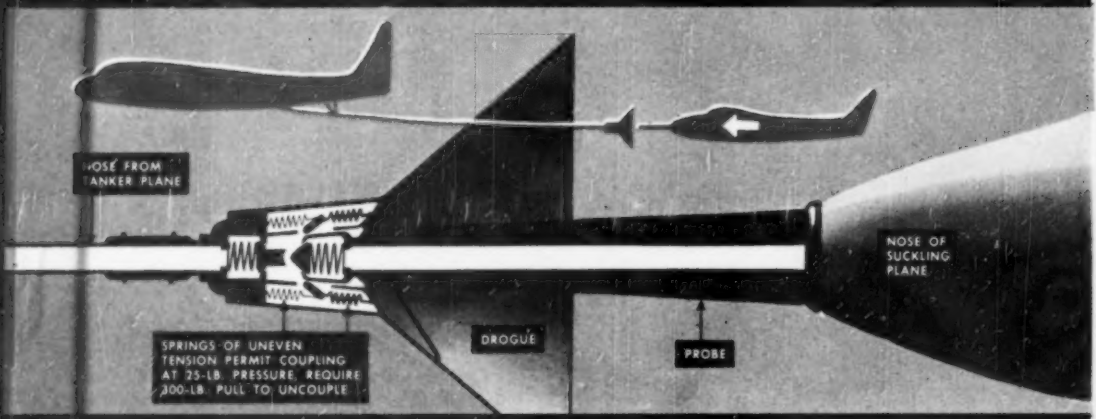
It solved, finally, the most serious drawback of the airplane—its inability to carry a great load a long distance nonstop.

The fast, automatic transfer of fuel from tanker planes to military and commercial aircraft has been 15 years in the making. Now it is a reality. In-flight refueling will become a commonplace for both bombers and fighters in the next few months. What this means in terms of air defense can be reduced to simple mathematics.

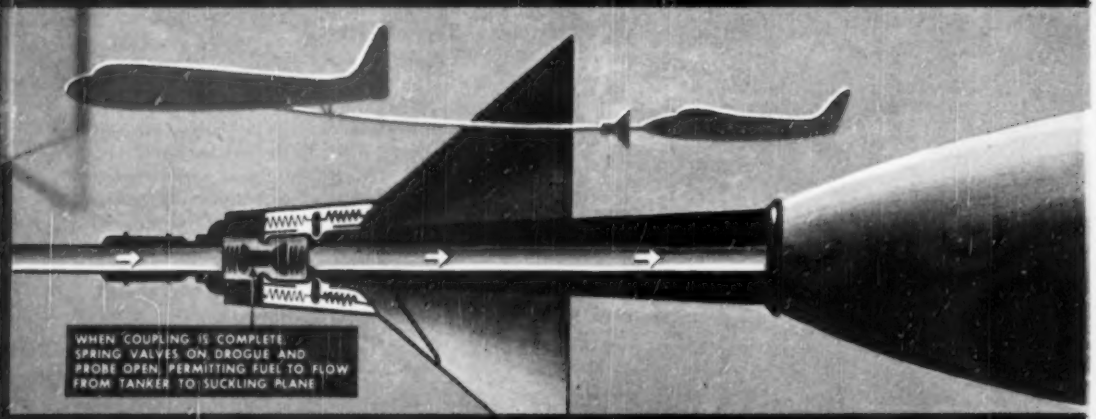
A bomber propelled by reciprocating engines and refueled once in mid-air en route to its target can carry *three times*




**One of two chief components** in flight refueling is 70-foot flexible-metal hose. In military operations, tanker carries it; in commercial refueling, the air liner will unreel it to the tanker.

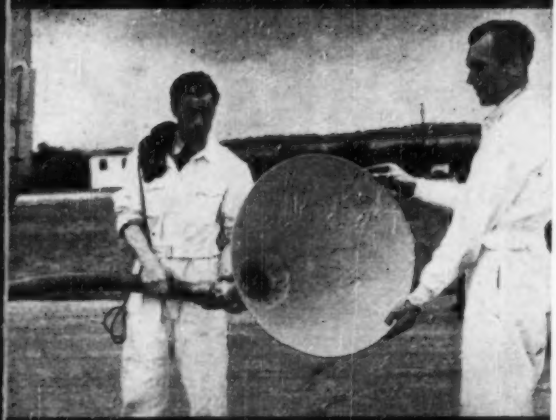



**Three toggles in drogue** clamp over annular groove in probe. Joint is sealed by synthetic-rubber ring. Plane carrying probe eases forward, and pressure flashes a green light in tanker cockpit.




**Tanker crew** then switches on fuel pumps. Play in drum rotation allowed by fluid clutch enables two planes to maintain contact if momentary speed differences are not more than 25 m.p.h.

**Crewman checks drum** amidships in tanker. Same equipment is used for ground refueling.



**Drogue's shape** can be changed so air flow positions it either above or below the tanker.

**Probe,** to be made retractable, feeds fuel to main inlet pipe above receiving plane's tanks.

the weight of bombs over any given distance that an unrefueled bomber can carry. On a round trip of 6,000 miles, a bomber smaller than the Boeing B-50, refueled once on its way to the target and once on its return flight, can carry 20 tons of bombs. (See "What Can Our Bombers Do Now?" PS, Aug. '48, p. 74.) Without refueling, it requires a bomber the size of that Air Force colossus the B-36 to tote the same load on the same operating radius and return to base.

In-flight refueling will also vastly simplify the problem of maintaining screens of air patrols for home defense in the event of war. The Air Force C-99 cargo plane, unarmed version of the Convair B-36, will be able as a tanker to haul aloft enough fuel to replenish the supplies of an entire squadron of 40 jet fighters—this at a pumping rate of at least 600 gallons a minute. The usual routine of take-off, fly, land, refuel, and take-off again will be a thing of the past. The pilot's physical endurance will be the only limit on the duration of a flight.

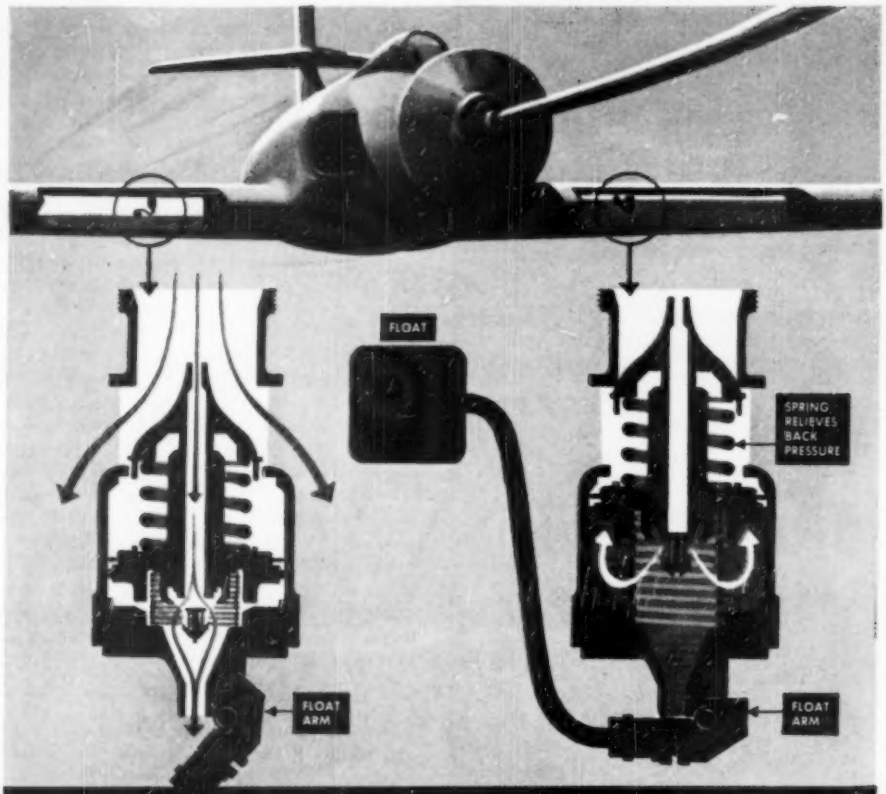
On the Navy's side of air defense it is proposed that tanker planes be based on its carriers to refuel its swarms of bombers, torpedo planes, and fighters at distances up to several hundred miles away.

### *Twice as Fast to Come?*

So seriously is the Air Force taking mid-air refueling that it is shooting at a fuel-transfer rate of 1,200 gallons a minute. The people who brought flight refueling to its present state say that such a rate is not only possible but highly probable in the near future. A fighter can be refueled in 90 seconds either on the ground or in the air as against 45 minutes on the ground by conventional methods.

Flight refueling isn't new. It was used 20 years ago to hang up flight-endurance records. Cans of gasoline were transferred from one airplane to another, or the fuel was passed down through a hose by gravity feed. As late as last February the Air Force B-50 bomber Lucky Lady II refueled four times by the hose-gravity method in its non-stop flight around the world. The Boeing Airplane Co., of Seattle, recently announced a refueling system based on a collapsible metal boom connecting the tanker plane and the plane being refueled. It worked, but the crew of the receiving plane had to "fly" its boom to the tanker plane to make the connection. That needed a trained crew.

What *is* new about flight refueling is




**Each fuel tank** in plane being refueled is equipped with special valve to provide automatic shutoff. Plane can be fitted with selector valve to permit filling each tank individually.

the system developed by Flight Refuelling, Ltd., of England, now being adapted for use by our armed services. Here is why it had to be developed:

Inherently, the airplane is an inefficient vehicle for transporting passengers, goods, or bombs. It eats up too much fuel in the process. Even with reciprocating engines instead of the more voracious jets, it consumes three to four times the weight of fuel required by a motor bus, for instance, and even at that will transport only two-thirds of the bus's payload. Weight for weight, it uses more than twice the fuel of a transatlantic liner and carries only a third the payload, even with stops to gas up.

Big planes capable of carrying enough fuel for nonstop flights of more than 3,000 miles are not only expensive to build and operate, but they also can carry only about 1/25th of their fully loaded weight as "useful" or payload—passengers, cargo, or bombs. Capt. C. H. Latimer-Needham, Flight Refuelling's chief engineer, points out that there is a limit to the distance airplanes can fly nonstop, regardless of size, without dangerous overloading—when *all* the disposable load (passengers, cargo, *and* fuel) takes the form of fuel. In the opinion of some authorities this limitation would prohibit global air warfare—without refueling.

This characteristic of airplanes, in fact, is at the bottom of the hullabaloo between the Air Force and the Navy over the use of the Convair B-36 as an intercontinental defense weapon. The plane can go just so far, so fast, with a given weight of bombs, and it is astronomically expensive to build.

Airplanes have another characteristic that made flight refueling inevitable. Unassisted by Jato (jet-assisted take-off) bottles to augment the thrust of the engines, they can

lift off the ground less total weight than they can actually carry once they are aloft. That old standby, the DC-4, can tote a ton more weight in the air than it can take off the ground. The air liner you board at your local airport cruises on a third to a half the power, once it gets going, than it requires to become unstuck from the runway. A plane designed for flight refueling will save weight on take-off by carrying less fuel and thus will need less take-off power.

Flight refueling means a lot more than the mere transfer of gasoline for reciprocating engines—or kerosene or other high-ignition-point fuels for gas turbines—from a tanker plane to fighters, bombers, and air liners. That sounds simple until you get into the operation itself. Then troubles begin.

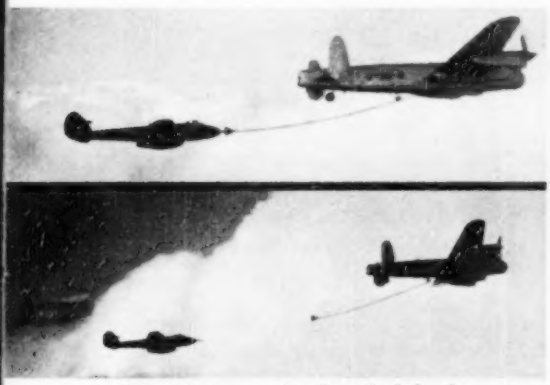
In the first place, the transfer of fuel from one airplane to another is dangerous. A way had to be devised to protect highly flammable liquids from ignition by hot exhaust pipes or static electricity. That meant the invention of a "closed system"—one in which not a drop of fuel could escape to the open air while it was being transferred.

A second problem was the designing of automatic cut-off valves to stop the flow of fuel **at the split second that the** receiving plane's tanks are brimful. Another problem was making an easy and routine physical connection between the tanker plane and the plane to be refueled. Still another was making the fuel flow fast enough to complete the operation within a few minutes, even in the case of big aircraft requiring thousands of gallons. And still another was how to prevent the tanker and the plane being refueled from becoming unhitched if speeds didn't quite match.

And there were lesser questions to be answered. Among them was how to bring together the tanker and the plane to be refueled in the unmarked vastness of space—to avoid a game of hunting for a needle in a haystack. Another was how to make the tanker crews comfortable in sub-freezing temperatures at altitudes of 20,000 to 25,000 feet. Refueling operations had to take place at that height if the airplanes were to get above most of the bad weather and make visual contact. Another problem was how to make mid-air refueling universally practical without the expense of training large numbers of crewmen to use it. And still another was how to prevent "vapor locks" in the refueling lines when the fuel began boiling in the thin air of high altitudes.

All these problems were tackled in 1935 by Sir Alan J. Cobham, noted British flier, aviation engineer, and present chairman and managing director of Flight Refuelling, Ltd. By 1939 his refueling system was being used to supply gasoline to British flying boats plying between the United States and England. Then the war interrupted commercial research work.

Flight refueling became a wartime project in 1943-44 when it was proposed to equip 1,250 British Lancaster bombers and tankers with fuel-transfer systems. The bombers were to be used for attacks against Japan from Burma, 2,500 miles away. The plan was dropped when the United States



**Operation completed,** refueled plane eases back until hose is extended to fixed limit. Two pawls lock drum. Further pull by plane disengages probe, automatically shuts off fuel.

**In Boeing system** for refueling bombers, telescoping pipe or boom is "flown" by controls called ruddevators to tanker plane. It requires, however, a trained crew in bomber.

made unexpectedly rapid advances across the Pacific.

With the war over, Sir Alan's company renewed its work on refueling development. Experiments in 1946 included 25 day and night refueling tests over the North Sea and the English Channel. In the first sustained operations with commercial planes, the company based its tankers at Santa Maria in the Azores to refuel nonstop flights of British South American Airways to Bermuda.

### *Transatlantic Freighters Refueled*

Next, Sir Alan decided to try winter refueling over the North Atlantic. He collaborated with British Overseas Airways in refueling nonstop flights by freighter planes between London and Montreal. Tankers based at Shannon, Eire, refueled planes within a radius of 500 miles of that base. Other tankers from Gander and Goose Bay, Newfoundland, performed a second refueling operation east of those bases.

Once radar and cabin heating failed them. Another time the fuel-tank valves failed to open due to an experimental change in positioning the tanker lower and more rearward of the freighter plane. But on no occasion did the tankers fail to take off from their bases despite snow, fog, icing conditions, and temperatures as low as −35° F. On some occasions the freighters made their westward crossings against headwinds that caused the regular transatlantic airline traffic to be diverted to Iceland.

It was in part Flight Refuelling's equipment that was employed by the U. S. Air Force in the globe-girdling trip of the B-50, Lucky Lady II. Recently a jet fighter, the Gloster Meteor Mark IV (PS, Oct. '49, p. 131), having a normal flight time of slightly more than an hour, was kept aloft for 12 hours 3 minutes with ten refuelings.

An American company, Flight Refueling, Inc., of Danbury, Conn., has taken over distribution of the system in this country for its British counterpart. Right now, its customers are only the Navy and the Air Force, but the company is confident that American commercial air liners will soon be taking flight refueling in their stride.

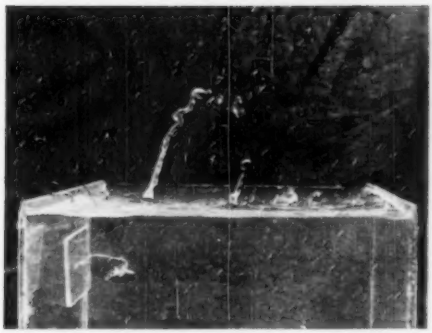
The advantage that flight refueling will afford jet aircraft, requiring some four times the fuel consumed by reciprocating-engine transports, when they begin flying the Atlantic is obvious. To the jets, flight refueling will be more than an advantage. It will be a necessity. END

## Folding Truck Saves Space

WHERE space is a problem, this new hand truck that folds up can be used to move heavy items. When not in use, it folds down to a height of only nine inches. Called the Fold-A-Way® by the distributor, Business Equipment Specialists, of New York City, it weighs only 25 pounds but will take a load of 700 pounds.

## "Keymonica" Teaches Music

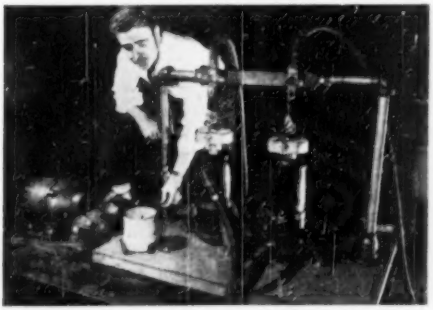
THIS plastic musical instrument is called a Keymonica®—a cross between a clarinet, harmonica, and button accordion. With ten buttons for 20 notes, it can be used in teaching the fundamentals of music. Even the reeds are plastic, and it can be cleaned by washing in warm water. It is made by the Magnus Harmonica Corp., of Newark, N. J.

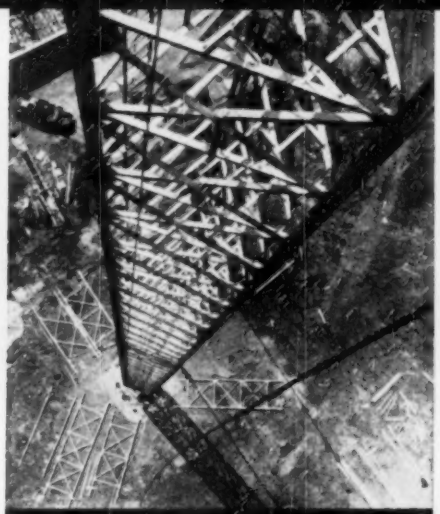


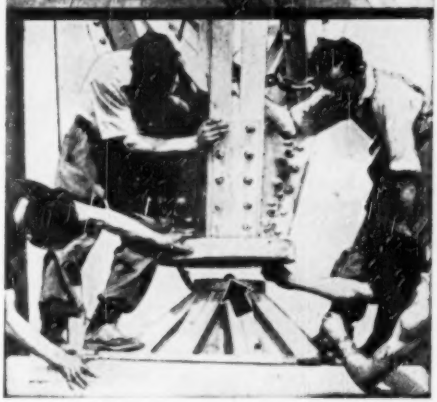
## Sound Makes Odd Fountain

JETS of water spurt mysteriously from the surface of the tankful above. They're made when electric voltage vibrates a dime-size, concave disk of barium titanate suspended in the liquid. Oscillating nearly 3,000,000 times a second, the disk produces ultrasonic waves (too high-pitched for human ears to hear) for study by GE engineers.

*They're amateur radio operators. He won't be able to keep a pre-arranged radio contact (sked) with an Australian (VK) amateur because he is still trying to eliminate difficulties in the transmitter (rig).*





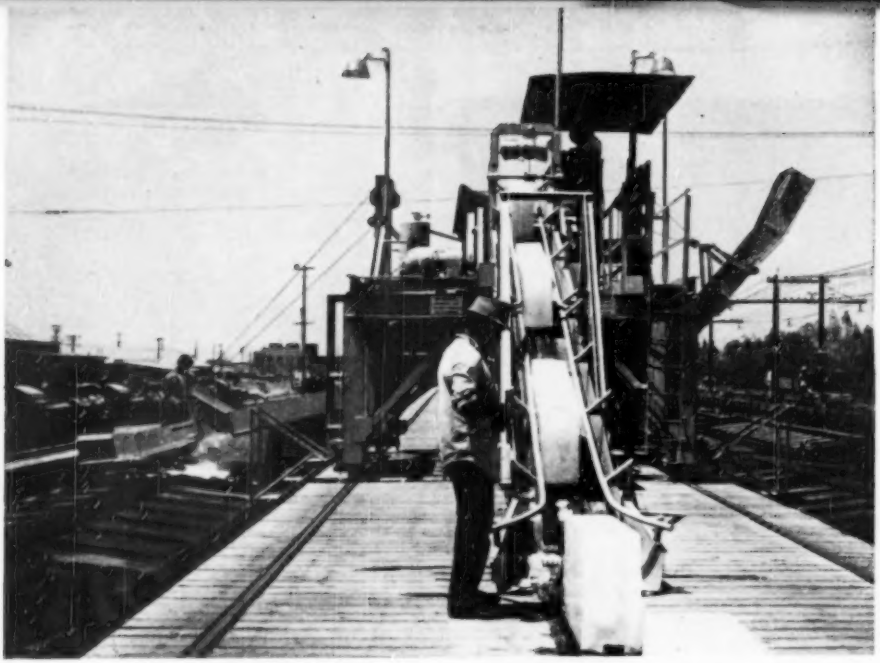


## Tiny Ball Supports Tower

A BALL bearing just two inches in diameter supports the weight of Britain's tallest television mast, the 750-foot tower shown under construction in two views above. Held upright by guy wires, the 100-ton mast will pivot on the tiny sphere, seen at the center of its convex base in the lower view, to allow for "give" in a high wind.

## Tubes Get Jitterbug Test

BY CONVERTING alternating to direct current, Westinghouse ignitron tubes at left enable electric locomotives with light and compact DC motors to use power from low-cost AC transmission systems. Fears that jolting the liquid mercury in the tubes might interrupt their power were proved groundless by the "jitterbug" table shown, on which they performed smoothly for a month, although its 180 jiggles a minute emptied a cupful of water in two seconds.

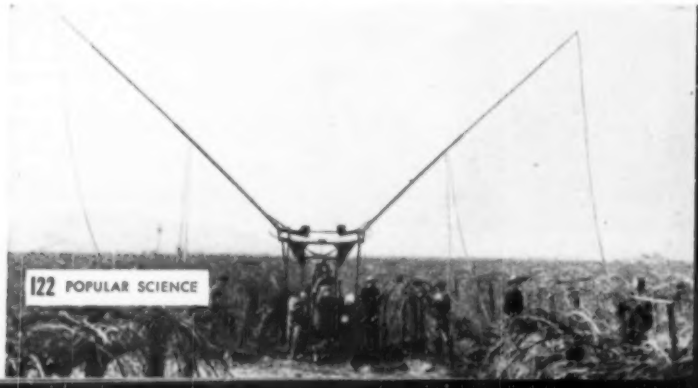


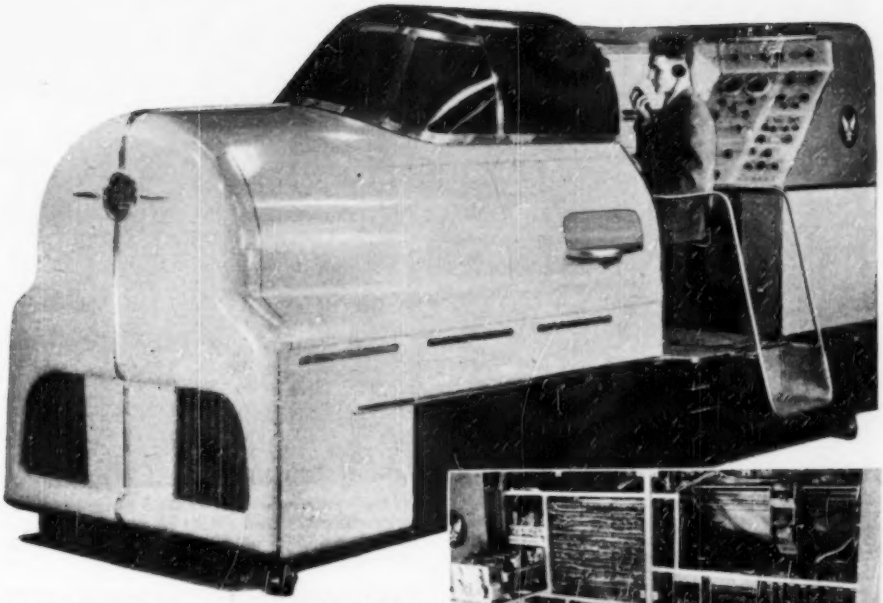
## Electronics Ices Freight

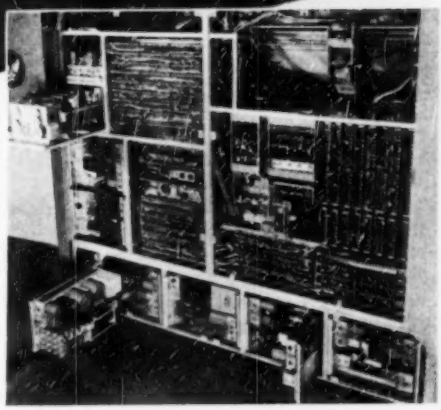
REFRIGERATOR cars filled with perishable fruits and vegetables now get quick, push-button icing at Bakersfield, Calif. This huge machine pours five tons of crushed ice into a car's bunkers in 90 seconds. Moving like a giant, antennaed spider along rails on a raised icing dock, the machine straddles a chain conveyer leading from an ice-storage house. As it moves, it scoops up forty 300-pound blocks of ice a minute, crushes them, and feeds cars on both sides of the dock. The operator on the bridge electronically controls the flow of ice, raises and lowers the chutes, and regulates the crush from coarse to fine, depending on the product being iced. The machine, developed by the Railways Ice Co. and the Santa Fe Railway, is operated by six electric motors powered through a trolley wire running underneath the dock.

## Small Air-Gun Shears Lop Big Limbs

LIGHTWEIGHT and fast-acting, the new Limb-Lopper ® at right below is designed for easy, one-handed pruning of vines, shrubs, or trees. For large-scale vineyard operations, as seen at left below, it can be attached to a mobile rig having as many as eight air lines fed by a single large compressor. Used singly, it requires only a small compressor and thus is also ideal for pruning in parks and on estates. Weighing only 1¾ pounds, the 14-inch tool will cut limbs up to ¾ of an inch thick by the pressure of a trigger. With a slight rocking motion, it can make bigger cuts. Speed is obtained because the air pressure is used to open the blades as well as close them. The clipper is manufactured by the Miller-Robinson Co., of Los Angeles, Calif.







**At the base** of the new Link Jet Trainer (above) is its brain (right), consisting of 24 electronic computers. Each individual chassis rolls out on casters for inspection and servicing.

# Jet Jockeys Get Ground Go-Around

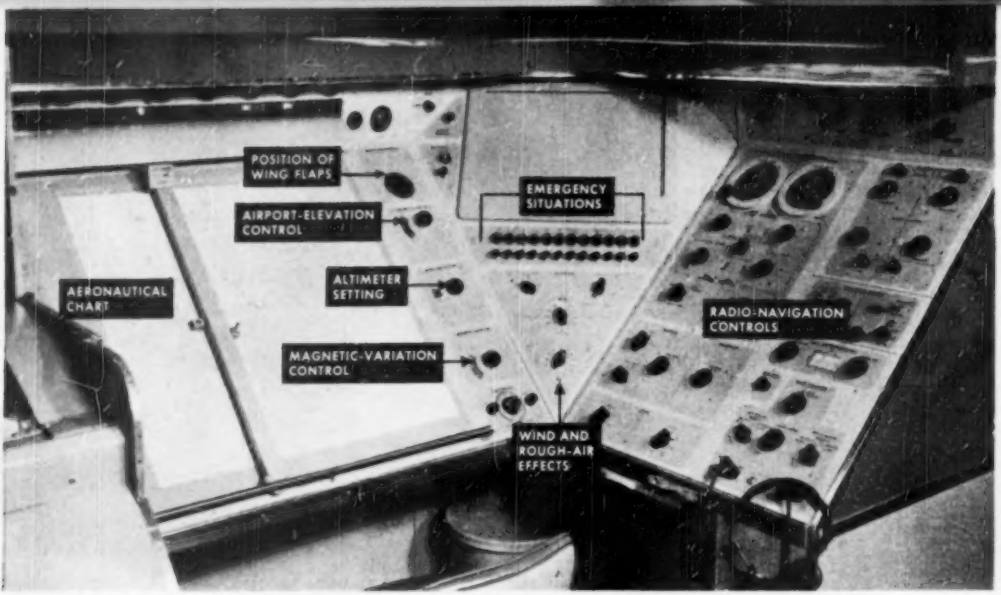
***By Herbert Johansen***

THE speeding F-80 jet fighter's tailpipe is dangerously hot. The pilot doesn't notice the warning signal on his cockpit panel. In a matter of seconds the pipe burns out and his engine is disabled. But in this case he doesn't crash. A check pilot simply pushes a button and the world's first jet instrument trainer gives the pilot a new engine, a new tailpipe, and a new start.

As in conventional Link trainers, the pilot has of course never left the ground. But although the trainer has not moved an inch, he has experienced all the conditions of subsonic flight on his instruments, and the actual "feel" of flight on his rudder pedals and stick.

The new trainer, developed for the Air Force, is more than just an electronic teacher of instrument flying. It also checks the pilot on radio navigation, operation of his engine, proper fuel consumption, and how to deal accurately and swiftly with emergencies.

Since coping promptly with emergencies is vital at jet speeds, the check-pilot instructor, sitting behind the hooded cockpit, has buttons for introducing a variety of operating troubles, ranging from a fuel-tank puncture or a fire to a complete engine failure. For added realism, the instructor can feed




**The instructor's console** is located immediately to the rear of the hooded student's cockpit. The instructor faces a recorder panel (left) that traces simulated flight on an aeronautical chart. In the center are push-button controls to feed in emergencies, and (right) fuel and radio controls. A window at far left (not visible) permits observation into cockpit.

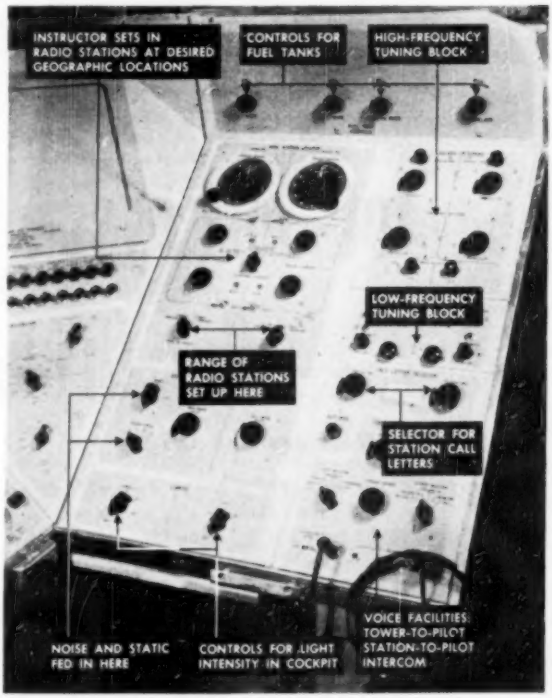
in lightning flashes, simulate rough air or high winds, and duplicate wing icing.

While the student is being bedeviled by all sorts of troubles, electronic watchdogs keep tabs on his every action. A set of duplicate instruments tells the instructor exactly how the plane is flying. If the student does not follow engine-operation procedure to the letter, failures occur that are indicated to the instructor through tell-tale lights.

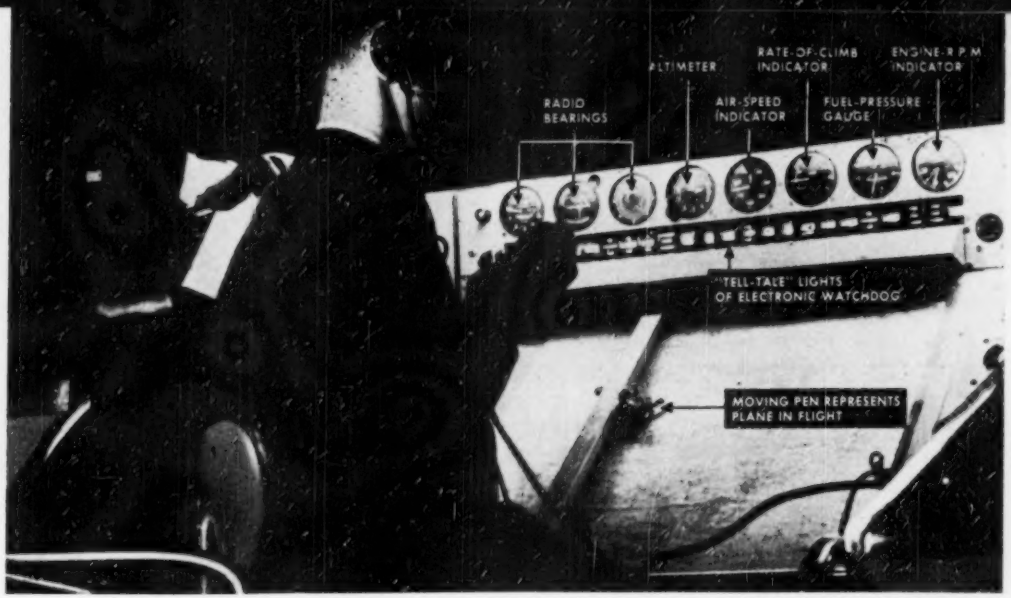
One important feature of the new trainer is the completeness of its radio-navigation instruments. Such devices as a radio magnetic indicator and distance-measuring equipment enable the pilot to determine his position and course by looking at instruments rather than by listening to radio signals. Instrument approaches can be practiced, too.

Station locators permit setting in two radio stations at any geographical location on the chart being used. The location and characteristics of the stations may be changed while the flight progresses. By "leapfrogging" them, always keeping one station ahead of the student, the check pilot can supervise the student as he makes a thousand-mile cross-country "flight."

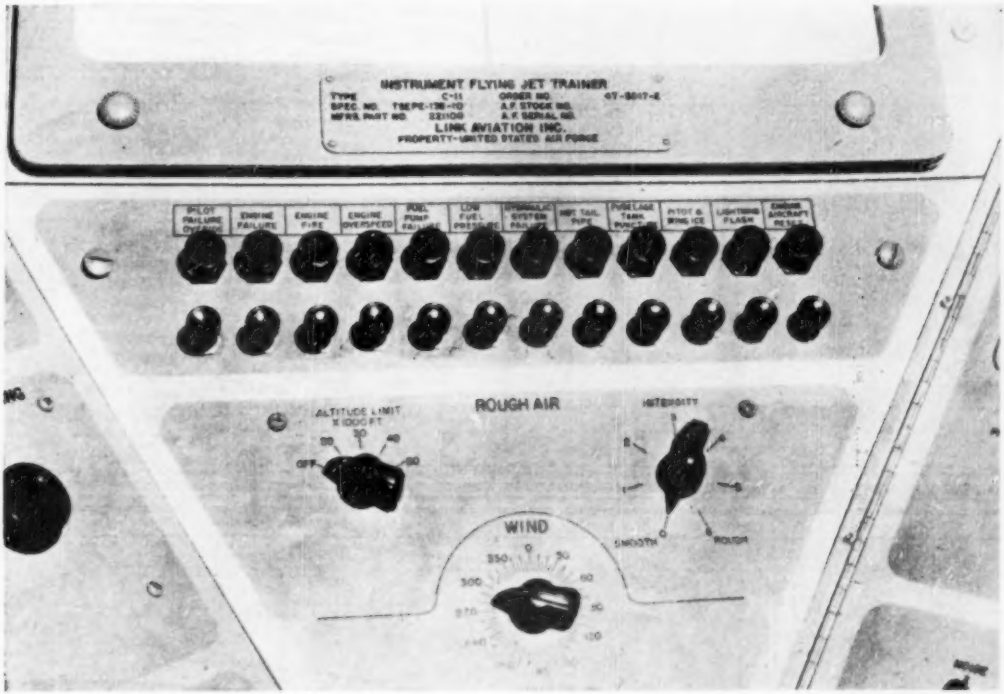
During such flights, instrument settings can be varied to simulate changes in atmospheric conditions and airport elevations, while an automatic recorder traces the path across an actual aeronautical chart.




**At top of the radio panel** are controls for filling the fuel tanks to any desired capacity. Controls below permit the instructor to set up a wide variety of radio-navigation problems.




**Close-up of the recorder panel** shows eight repeater instruments on top that duplicate readings in the pilot's cockpit, enabling the instructor to follow student performance. Directly below is the row of 32 tell-tale lights that signal pilot errors and their effects on the plane's operation. Next is the flight-recorder pen that moves over an aeronautical chart.

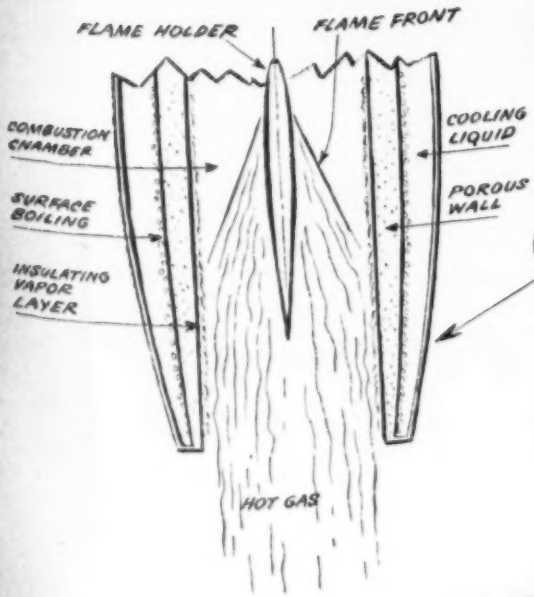



**Here's trouble** for the student pilot. If his reaction to any of the various emergencies fed in by the instructor is wrong, the error shows up on the row of tell-tale lights. If the student becomes hopelessly snafued, the instructor can press the "angelic switch" at far left. The effect of this is to clear all troubles and give the student a fresh start at tackling the problem.

# One Hour—Broadway

WHEN a real expert talks rocket ships, the amazing-fiction boys take a back seat. Dr. Hsué-Shen Tsien is a real expert—director of the Guggenheim Jet Propulsion Center at Caltech. Here's his idea of a rocket ship that could be built right now. The sketches below were adapted from Dr. Tsien's own drawings.

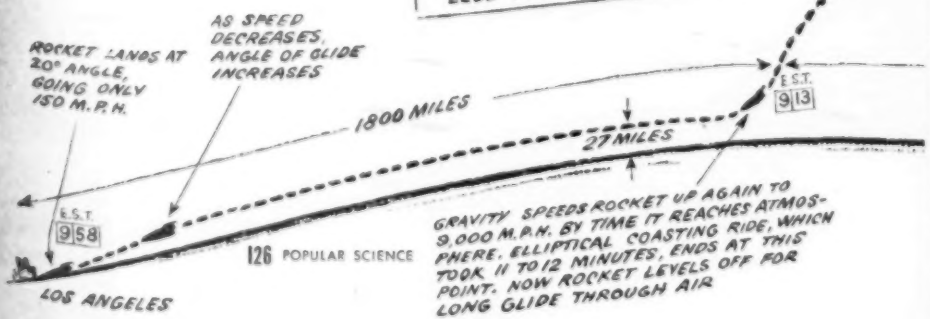
This liner could shoot 20 people coast-to-coast in less than one hour. It would




SAME MOTOR IS BOTH ROCKET AND RAM-JET. WHEN USED AS RAM-JET, CIGAR-SHAPED FLAME HOLDER DIRECTS AND HEATS FUEL GASES SO THAT FLAME STAYS IN PROPER POSITION. COOLING LIQUID CIRCULATING AROUND MOTOR IS SEPARATED FROM COMBUSTION CHAMBER BY POROUS WALL. ON "COLD" SIDE OF WALL LIQUID BOILS TO TAKE UP HEAT FROM WALL. VAPOR THEN SWEATS THROUGH WALL TO "HOT" SIDE, FORMING THIN INSULATING LAYER FOR FURTHER HEAT PROTECTION

ALTERNATE METHOD OF COOLING MOTOR, CALLED "FILM COOLING", SQUIRTS LIQUID THROUGH HOLES IN WALL. RUSHING HOT GASES IN MOTOR SPREAD LIQUID ALONG "HOT" WALL, FORMING INSULATING FILM. FOR BEST COOLING, FILM MUST BE ONLY FEW MILLIONTHS OF INCH THICK.

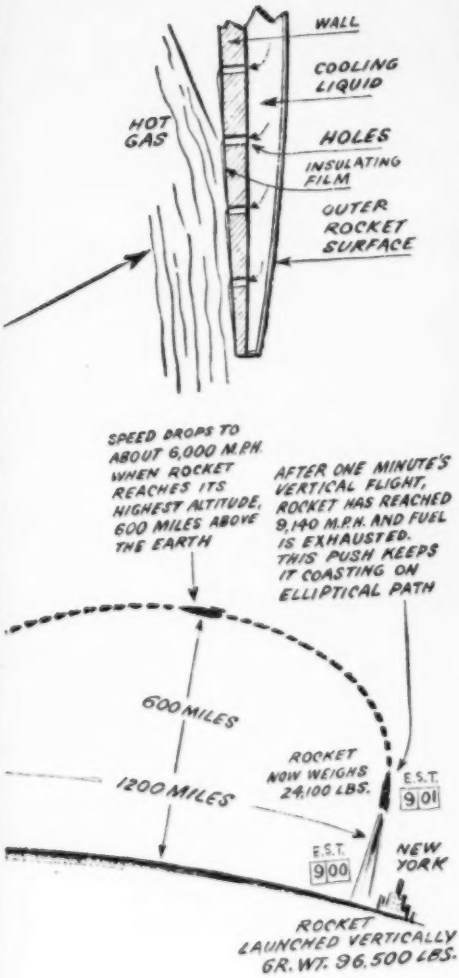
NEW YORK TO LOS ANGELES LESS THAN ONE HOUR

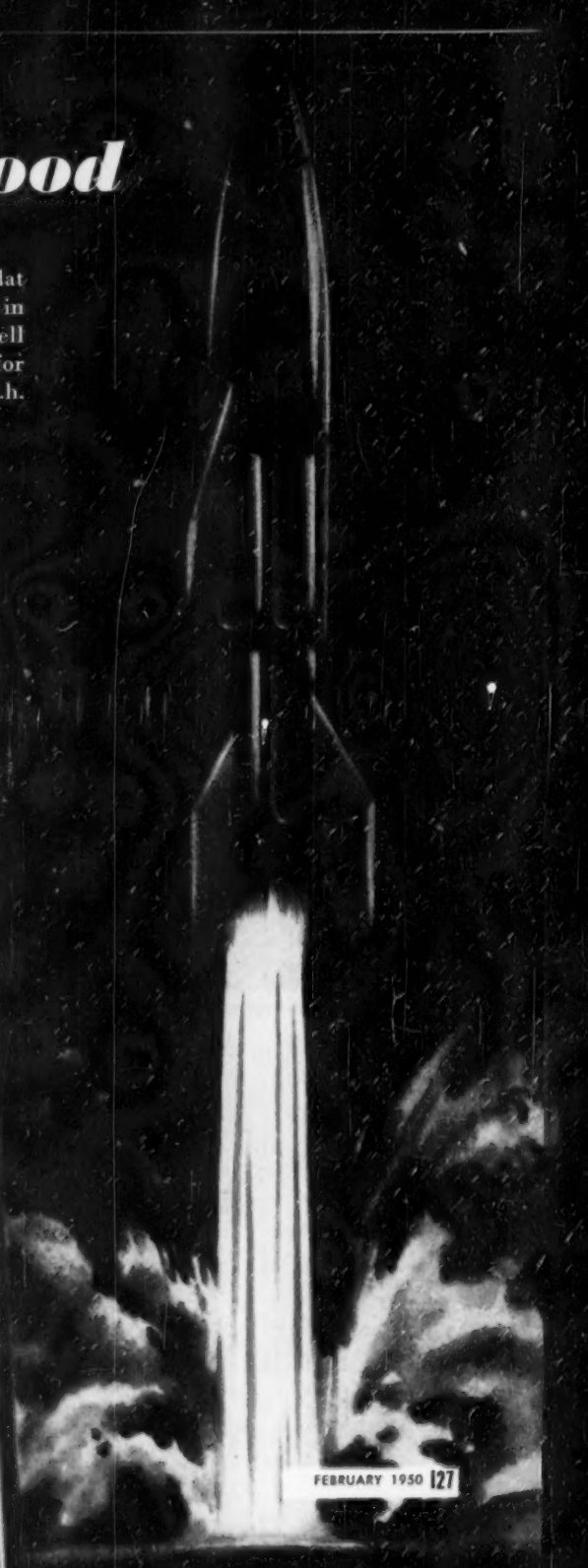


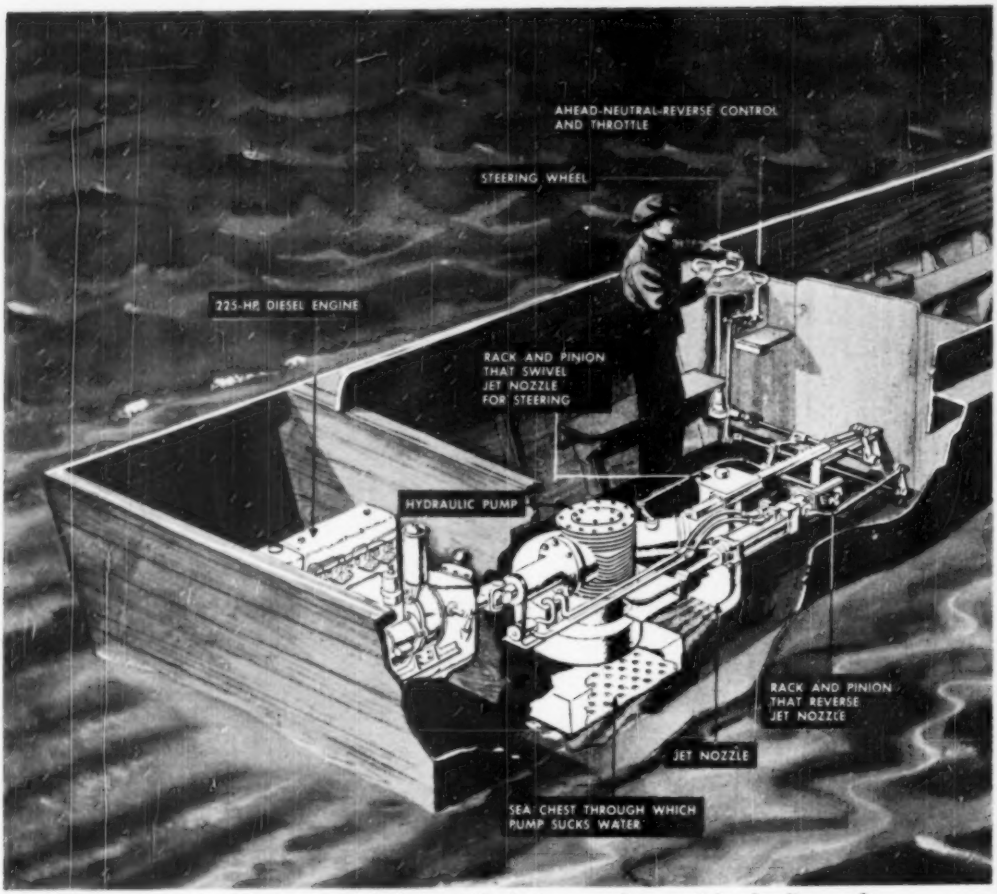

GRAVITY SPEEDS ROCKET UP AGAIN TO 9,000 M.P.H. BY TIME IT REACHES ATMOSPHERE. ELLIPTICAL COASTING RIDE, WHICH TOOK 11 TO 12 MINUTES, ENDS AT THIS POINT. NOW ROCKET LEVELS OFF FOR LONG GLIDE THROUGH AIR

# to Hollywood

take off vertically—with passengers flat on their backs—zoom to 9,140 m.p.h. in one minute, coast like an artillery shell for 1,200 miles, then glide on wings for 1,800 miles. Landing? Level, at 150 m.p.h.



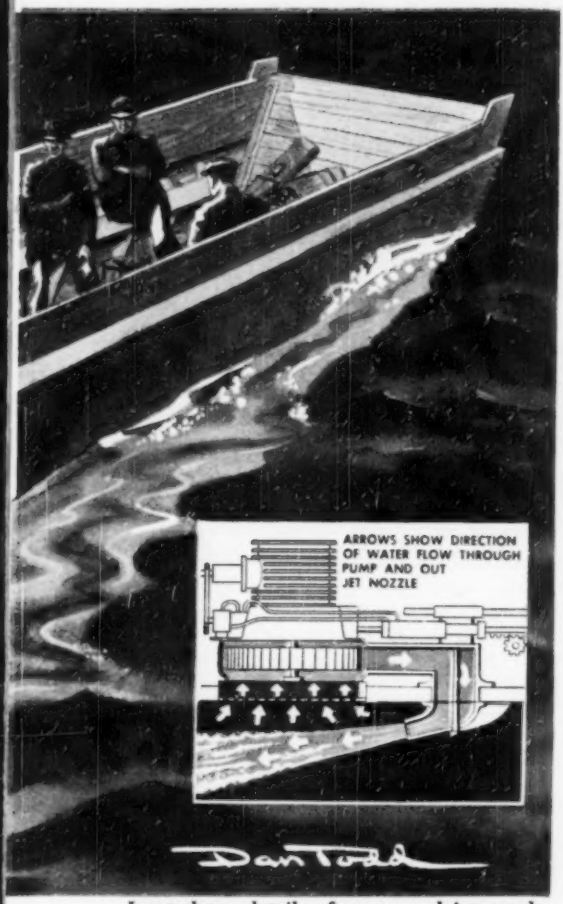






**Artist's drawing shows experimental installation of hydrojet propulsion unit in a landing craft.**

**A 14-foot pleasure boat,** propelled by water jet, speeds along at 15 miles an hour in a trial run. The boat draws only 3½ inches of water, and can turn around in its own length.

**Attach a hose to the pump unit,** and you have a one-man fire department. With the motor going at full speed, a stream of water can be shot 60 feet into the air under 85 pounds pressure.




**Inset shows details of pump and jet nozzle.**

# Water Jet Propels Boats

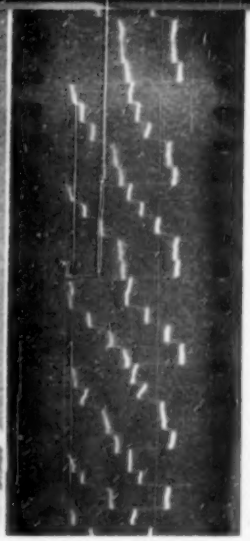
A POWERFUL jet of water replaces the propeller in a new kind of shallow-water craft that's being tried out by the Navy and Air Force. A conventional engine drives a pump that forces more than 7,000 gallons of water a minute out through a nozzle under the hull.

Steering is done by turning the nozzle to the right or left, up to 90 degrees, by a manual control. Reverse motion is obtained by a hydraulic control that swivels the nozzle 180 degrees. Thus the propellerless, rudderless boat can push its way through swamp mud that is 50 percent solids and climb over logs and other obstacles.

Developed by Hanley Hydrojet, Inc., of Prospect, Ohio, jet-propulsion units have been installed experimentally in swamp gliders designed for Air Force rescue work and in a Navy LCVP assault landing craft.

In backing off, the jet nozzle literally eats away the beach or mud bank, as in hydraulic mining. Hydrojet is also adaptable to small pleasure craft and fishing boats.

**A Navy LCVP landing craft,** using hydrojet propulsion, is shown above being beached at more than eight miles an hour. The boat literally climbed up on the beach to a distance that probably would have ruined a propeller, while the jet nozzle, protected by a shallow keel, was undamaged. A 225-hp. marine Diesel engine drove the pump of the Hanley Hydrojet unit.



**Movement of eyes** while reading test passage is photographed in opthalmograph. Film at right shows how many times eyes move, how long they stop, and if there's tendency to retrace.

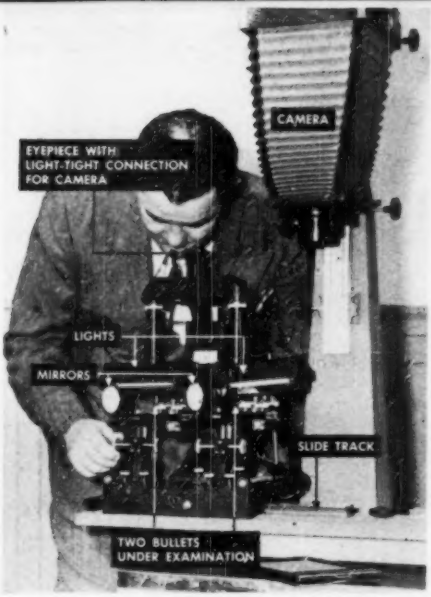
# Fliers Learn to Read Fast

IN THE Pentagon building there's an installation sometimes called "the place where they teach Air Force officers to read." This designation isn't quite accurate, of course, but a battery of ingenious gadgets there is helping the fly boys read faster and better. In some cases they double or triple their reading speed during a 30-hour course.

First the student must get rid of poor reading habits, such as moving his lips, or going back over a line because he didn't get it straight the first time. Then he builds new habits that make his eyes do double duty. That's where the devices below come in.

**Tachistoscope** is short-range projector with camera-type shutter. It flashes numbers on screen at varying speeds. Idea is to learn to recognize longer series of digits in shorter time.

**Reading-rate controller** has a motor-driven slide that moves down page at predetermined rate. Reader must go fast enough to keep ahead. Afterward he is tested for comprehension.




## Microscope Compares Bullets

LATEST of scientific police weapons is a new comparison microscope that quickly shows whether two bullets were fired from the same gun—and then takes a photograph of what it sees. Made by Bausch & Lomb with the needs of small cities in mind, it also compares fingerprints, hair, tool marks, and other small objects or markings. A sliding base permits the microscope to be focused visually and then pushed under the camera.

## Slots Steer Parachutes

THE Air Force is cutting pieces out of its parachutes now—slits that let a jumper "steer" to a good landing spot. Variations of the "Derry slot," currently in use by the Air Rescue Service, spill air from underneath the canopy without collapsing the 'chute. The spilled air causes the parachute to slip in the direction in which the air is escaping. Thus the jumper can head in any direction he wishes, or even turn completely around.

## Dishwasher Rolls to Sink

A NEW low-cost dishwasher lightens one of the most tedious of household chores. Priced at around $170, the manually controlled GE portable washes and rinses up to 100 pieces of table and cooking ware at once, but requires no permanent installation. It is simply pushed to the sink, plugged into an electrical outlet, and hooked to the faucet by a special hose. A high-speed impeller sprays hot water and detergent over the dishes. The drain hose discharges right into the sink without any connection.

# Digging Oil out of the Wilderness

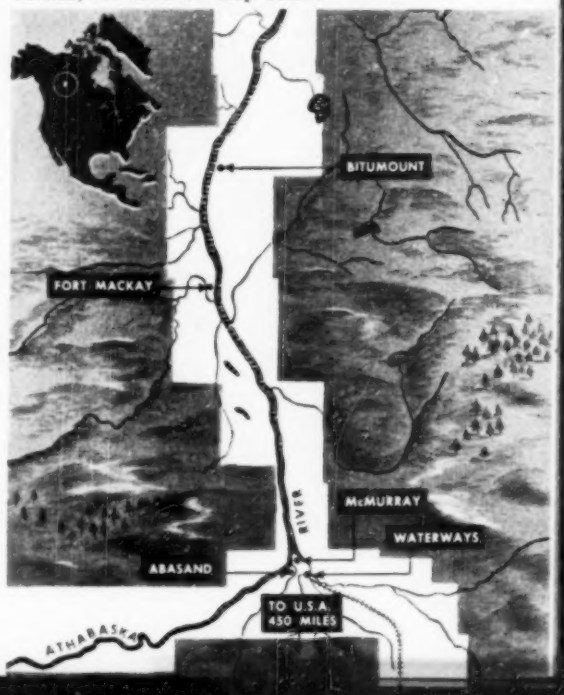
**This open-pit mine yields oil—but a new kind of plant is needed to separate oil from sand.**

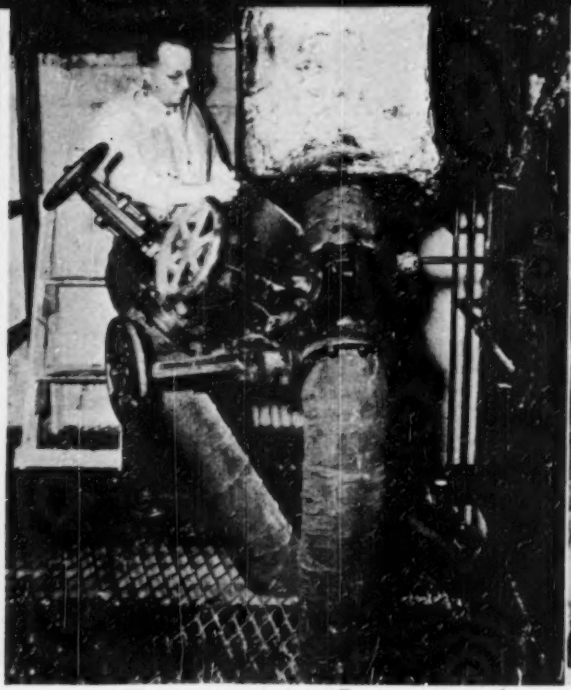
ONE of the world's greatest treasure chests was discovered long ago in Canada, but never opened. It is a bed of sand full of oil. Power shovels can scoop it up, but gas pressure does not force this oil into wells—and getting it out of the sand has been prohibitively expensive.

Last summer the Research Council of the Province of Alberta began to extract oil from this rich black sand in a pilot plant at Bitumount, where these pictures were taken. In this new plant, the sand is mixed with hot water and agitated so that the oil rises and can be skimmed off. The sand sinks and is pushed out at the bottom of the separation tank by a screw conveyer.

Dr. Karl A. Clark, of the University of Alberta, believes that this is likely to prove to be the simplest and cheapest of the various methods that engineers have suggested; but difficult engineering problems may have to be solved to keep such a plant going economically. By operating the Bitumount plant, Alberta authorities expect to determine the cost of further efforts to obtain this oil on the earth's surface.

**Scores of billions of barrels** of oil are locked in sand beds in the vast, cold, and desolate Athabasca River valley of northern Alberta, Canada, shown in the map below.



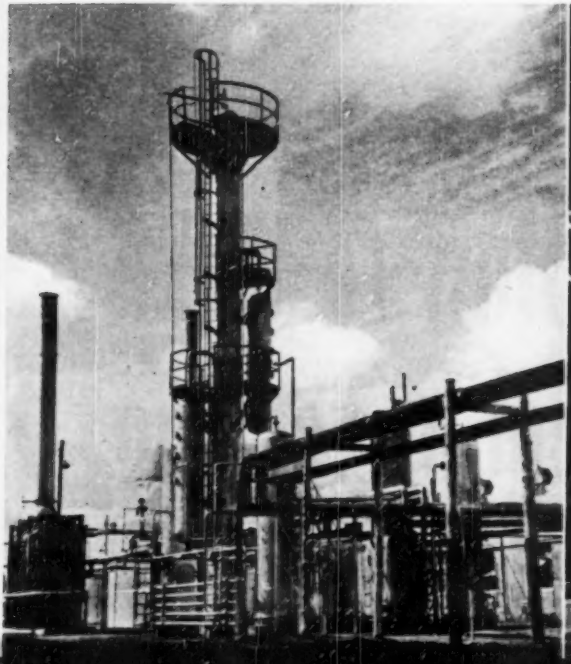


**Hot water is used** in Alberta government's experiment in extracting oil from sand. The valves shown here control flow. When mixture of water and sand is agitated in a separation cell, sand settles to bottom and air bubbles carry particles of oil to surface.

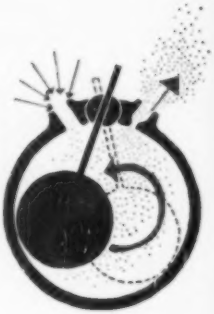
**Rotating paddles** like this skim the froth that contains oil from surface of hot water, and water is recycled for use again at the rate of 400 gallons per minute. Further treatment of the froth yields crude oil similar to that which comes out of an ordinary well.

**Experimental plant's capacity** is 350 barrels a day—too small to be commercially important but ample for determining costs. Refining unit is shown below. The tower in center is a flash chamber and fractionator for separating crude into various products.

**Constant laboratory checks** are made to determine efficiency of the process. Plant employs from 18 to 60 men, who communicate with civilization by two-way radio. Engineers and scientists of Research Council of Alberta consider the initial findings encouraging.

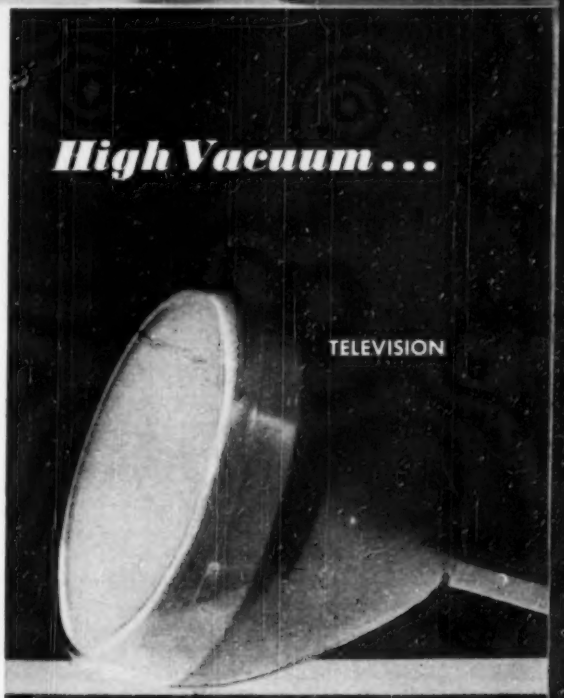


**Diffusion pumps** create the highest vacuum. They use jets of oil vapor to push air molecules from top to bottom of pump and out the valve.



**Mechanical pumps** have off-center wheel to sweep air from one side of cylinder to other. Sliding vane separates sections.

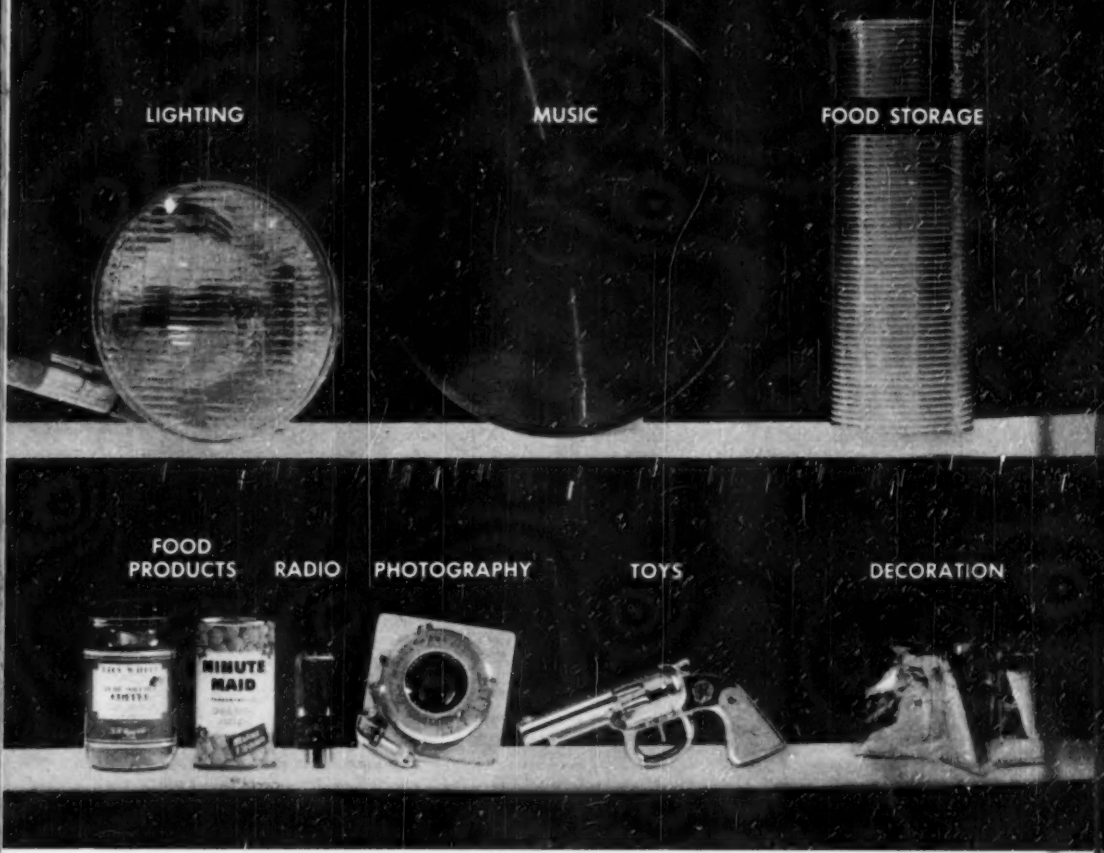
**Steam-jet pumps,** producing moderate vacuum in big tanks, work on same principle as diffusion pumps, but use steam instead of oil.



**Three types of vacuum pumps, shown in drawings at left above, help produce all kinds of new**

# How to Make A Lot Out of Nothing

# ...You Use It Every Day




**and better products—from frozen orange juice and penicillin to TV tubes and auto headlamps.**

***New uses for high vacuum make empty space one of industry's important raw materials.***

**By Martin Mann**

*Drawings by Ray Pioch*

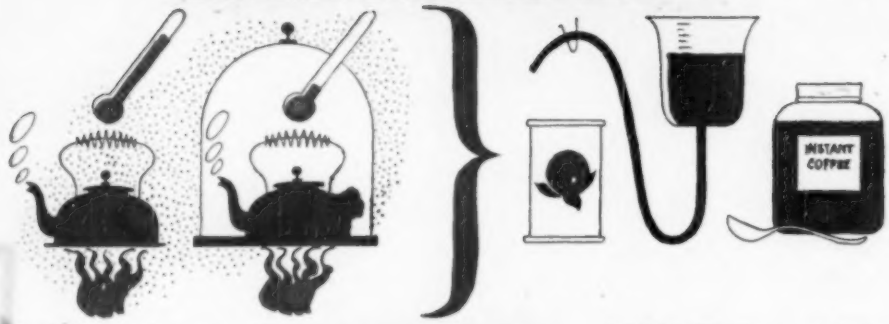
YOU'VE got to have air to live. Yet air can be a nuisance, too. Get rid of air—make a vacuum—and you can do a lot of wonderful and very useful things.

In a tank of "nothing" you can make water boil even when it's *cold*. You can dry things that are frozen solid. You can make electrons and atoms and molecules do your bidding: move from one place to another, taking the straight, short route or twisting around in curves. You can keep gas bubbles out of metal.

All these things are impossible under ordinary air pressure. The 400,000,000,000,000,000,000 molecules in every *cubic inch* of air literally get in the way and prevent them. Reduce the air pressure enough—remove enough air molecules—and such accomplishments become possible.

These things are not just tricks—not any more. New and improved vacuum

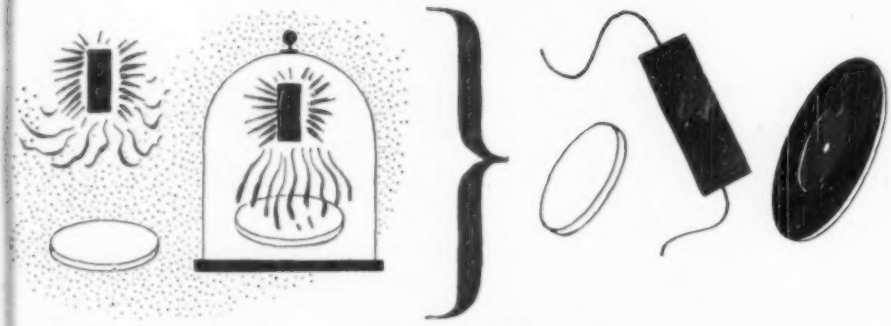
# THREE WAYS VACUUM HELPS YOU




**The lower** the air pressure, the lower the temperature at which water—or anything else—boils. In fair vacuum, cold water boils.

## BOILING THINGS WITHOUT HEAT

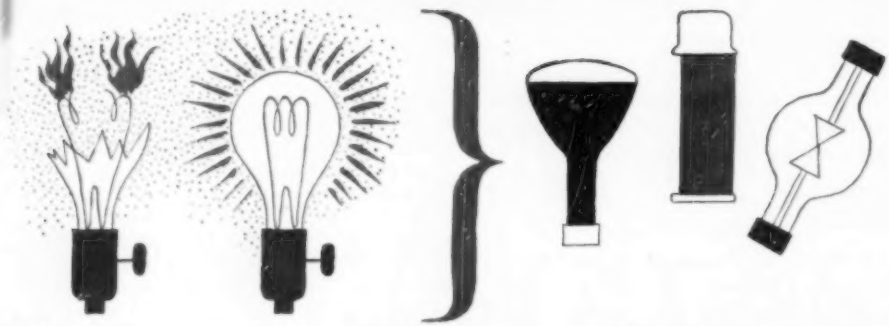
**"Cold boiling"** prevents heat damage in drying orange juice, blood plasma, and coffee, and in distilling some chemicals.



**To put thin layer** of one material on another, obstructing air molecules must be removed so coating molecules get through.

## REMOVING UNWANTED AIR MOLECULES

**These thin, smooth** coatings serve many different purposes on such varied things as lenses, condensers, record "masters."



**Without vacuum** right in the product you buy, some things—like light bulbs—would burn up, or not work at all.

## IN A PACKAGE

**This "packaged vacuum"** is put to work in television and radio tubes, food containers, X-ray tubes, and many others.

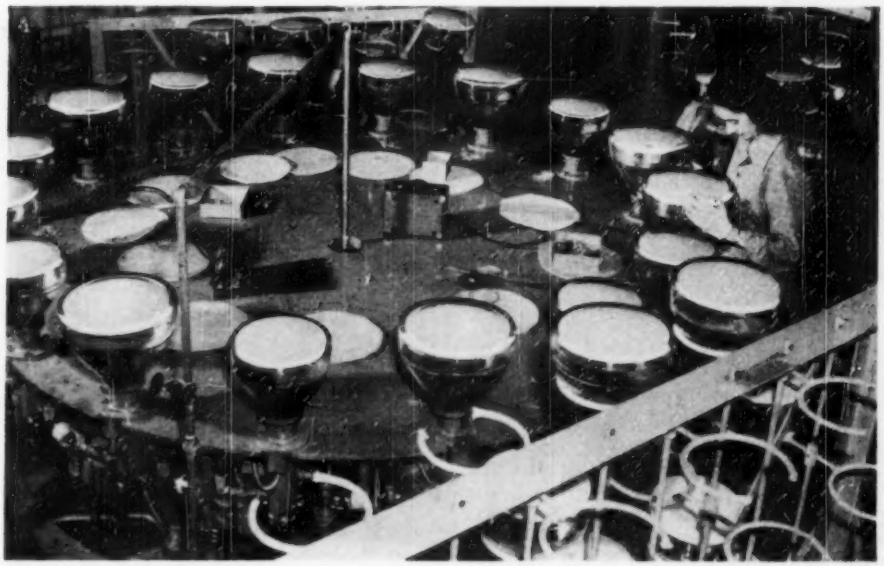
methods, many developed during the war, have pushed them out of the laboratories and into the factories. The techniques are now used every day to produce dozens of new products everybody is using.

Is your family one of many that make the morning orange juice by diluting a small can of frozen concentrate? One reason it tastes so much like fresh juice is the use of vacuum to make the concentrate. Maybe you have a new camera with a "coated" lens. The coating—which helps get a sharper picture with less light—must be applied in a vacuum. Those shiny, metallic toys you see in the dime store—they're plastic with a thin coating of aluminum, also applied in a vacuum. Or perhaps your doctor has prescribed penicillin, streptomycin, blood plasma, vitamins—they and many other pharmaceuticals can be made only with vacuum.

The new high-vacuum equipment helps make these things in several ways. For many products, it simply lets water boil off at a low temperature. You know that water boils below the ordinary 212°F. temperature when you're on top of a mountain, where atmospheric pressure is lower. If you were on a mountain top 20 miles high, water would boil between 50° and 60°F. The water would boil even though it's actually cold! Orange juice, grapefruit juice, and a new kind of instant coffee are concentrated just this way. A vacuum equivalent to a 20-mile altitude—about 1/50 of sea-level air pressure—is created in the evaporating tanks, so that the water will boil away at low temperatures. This "cold boiling" is what protects the taste; heating fruit juices and coffee affects their flavor. The same technique is used on blood plasma and germ killers, which heat would completely ruin. In many cases they are dried while actually frozen—the ice changes directly into water vapor without becoming a liquid (this is called *sublimation*). Cold boiling also purifies vitamins and other hard-to-get chemicals. But here the process is distillation without heat—the chemical itself boils, not water.

For some of the other vacuum-made products, the idea is to get rid of air molecules that interfere with other kinds of molecules. A great many "coated" items—lenses, automobile insignia and horn buttons, Sealed-Beam® headlamps, interference color filters, mirrors for astronomical telescopes and projection television sets, electrical condensers, toys, decorative cellophane, phonograph-record "masters"—owe their existence to this technique.

Here, the objects to be coated are simply placed in a vacuum tank, and the ma-



**TV tubes need vacuum** for several things. At GE, air is pumped out for coating inside with aluminum (above), then readmitted while working parts are put in, and finally pumped out again.

terial that makes up the coating is put in the center of the tank and heated until it vaporizes. The vapor solidifies again when it hits the parts being coated, since they are cold. With no air molecules to get in the way, the molecules of coating material can travel long distances and make a thin, smooth, very even coating. To provide all-around coatings—for three-dimensional items like toys—the pieces are mounted on long racks and rotated by a motor inside the vacuum chamber. This metallizing process requires a fairly high vacuum, about a millionth of sea-level pressure. Once a delicate, expensive laboratory procedure, it has now become so routine that toys are coated for less than a penny apiece.

High vacuum also helps in metallurgy, providing new methods of refining and treating some metals. Lithium, magnesium, and titanium, for instance, react with oxygen when heated to the temperature that will separate them from their ores. But refine them in a vacuum furnace, and there's no oxygen to cause trouble. Thanks to this vacuum technique, titanium—light, noncorroding, and very strong—promises to become an increasingly important metal for all kinds of uses (see PS, Dec. '48, p. 105).

### *Vacuum Casting Arrives from Germany*

Vacuum casting is only now being introduced in the U. S., although a German firm, Heraeus Vacuumschmelze, specialized in this work for many years. When molten metal is poured into a mold, tiny bubbles of gas become trapped in the metal, weakening the product. Cast in a vacuum, however, no bubbles can form and a "sounder" casting results. Vacuum-casting furnaces often involve tricky design—you have to be able to pour the metal into the mold without disturbing the vacuum. One way to do this is to hang the mold on an axle so that it stays level while the whole vacuum-chamber furnace tilts, pouring the metal.

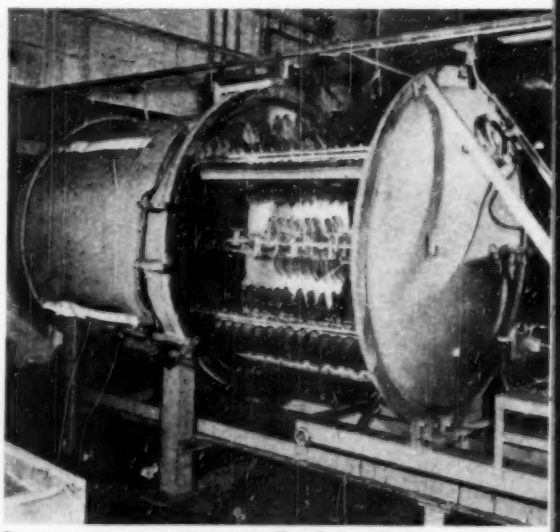
In many things, vacuum is not just involved in the manufacturing process but is a part of the final product. Electric light bulbs work only if the air has been removed from the bulb. Radio, television, and X-ray tubes depend on streams of electrons that would be stopped by air molecules. The atom smashers, like cyclotrons and betatrons, all require vacuum to work. And when you buy a Thermos® bottle, you pay mainly for "nothing"—the vacuum that does such a good job of heat insulation.

The atom-bomb project, perhaps the biggest research job of all time, depended greatly on vacuum. One device for separating uranium 235, which splits, from uranium 238, which doesn't, is a mass spectrometer. It sends mixed uranium atoms into a vacuum tank. A magnet makes the atoms curve as they travel. The lighter U-235 atoms curve more than the heavier U-238 ones, so they go into different collecting bins. The gigantic "Y-12" plant at Oak Ridge refines U-235 this way. It requires vacuum tanks each the size of a room and the biggest high-vacuum pumps ever made. Largely as a result of experience gained on this job, many of the new peacetime uses of vacuum became possible.

It's easy to make a low vacuum. People do it every day with a vacuum coffee pot.

But producing the high vacuum needed for the new things like orange juice and lens coatings—from a fiftieth to a billionth of atmospheric pressure—takes a lot of fancy engineering.

The pump that creates the highest of high vacuums is called a diffusion pump. Basically, it is nothing but a pot of boiling organic oil. (Sometimes mercury is used instead.) The oil vapor shoots out of jets, knocking air molecules away from the vacuum end of the pump. This "sweeping"



**Large vacuum tank** originally designed for coating lenses now gives beautiful metallic surface to plastic parts for toys, candy dishes, and other dime-store items. Racks spin inside tank.

action can reduce air pressure to almost 1/100,000,000,000 of its sea-level value.

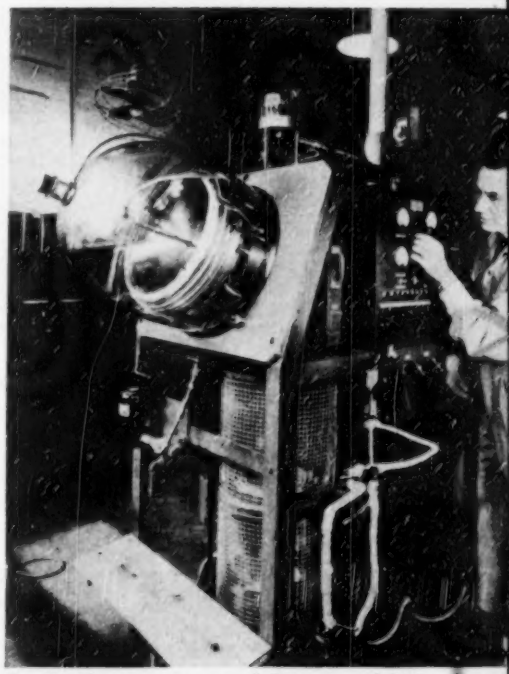
Mechanical pumps can lower pressure to about 1/100,000 of that at sea-level. A typical model consists of a wheel mounted off center inside a cylinder so that its edge always touches the cylinder wall, sweeping the air out. A sliding vane, one end resting on the wheel, separates the suction and discharge sections.

For pumping out large tanks to only a moderate vacuum, steam jets are used. Able to reach about 1/10,000 of sea-level pressure, they work something like diffusion pumps, but use steam instead of oil vapor to sweep out the air molecules.

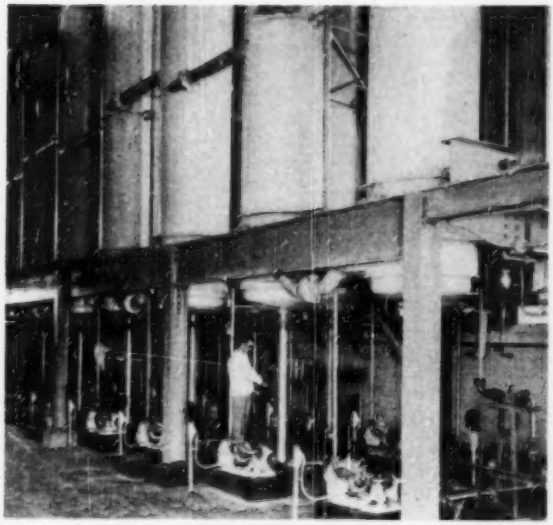
Although similar pumps have been available for years, it wasn't until simple ways to create good vacuums in large tanks were found that the present flood of vacuum-made products became possible.

You'd expect a large space to be harder to pump out than a small one. And it is, though not entirely for reasons you'd think. There's more air to handle, of course, but the container itself causes trouble.

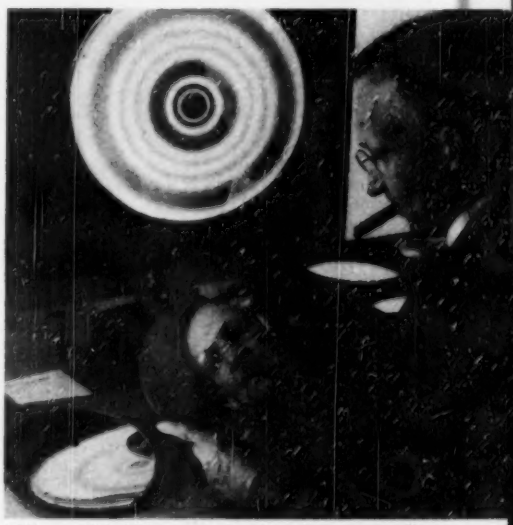
There's a lot of gas mixed right in with most materials—metals especially. Days of pumping may be needed before all this gas bubbles through the surface and out. For this same reason, many ordinary greases



**Coating lenses** was one of first uses of high vacuum. Photo above shows Kodak technician applying thin layer of magnesium fluoride that increases light transmission of optical parts.



**One of most spectacular** vacuum-made products is frozen fruit juice. Fresh taste results because water is evaporated at low temperature in vacuum. Picture shows Minute Maid® plant.



**"Mirrors"** held by Bausch & Lomb expert really transmit light, as one at upper left proves. They are "interference" color filters—glass vacuum-coated with silver and magnesium fluoride.

and gasket materials can't be used at all: they would never "outgas"—completely give up all of their gas molecules.

Leaks become more important, too. Even a small one can ruin the vacuum. And you can't use soapy water to find them the way you can in checking a leaky tire tube. Instead a mass spectrometer—a smaller edition of the Y-12 units that separated uranium for the atom-bomb project—is hooked up to the vacuum system. Then a jet of helium is sprayed along the vacuum pipes. When the helium hits a leak, the mass spectrometer indicates almost immediately that some helium has entered the system.

These and many other problems of evacuating big tanks were licked during the war, when tremendous quantities of coated optical parts, germ killers, blood plasma, and atomic explosives were needed. After the war, the companies specializing in vacuum equipment—National Research Corp., Distillation Products, Inc., and F. J. Stokes Machine Co.—quickly found peacetime uses for their know-how. Equipment designed to coat lenses, for example, now puts the shiny surface on toys and cellophane.

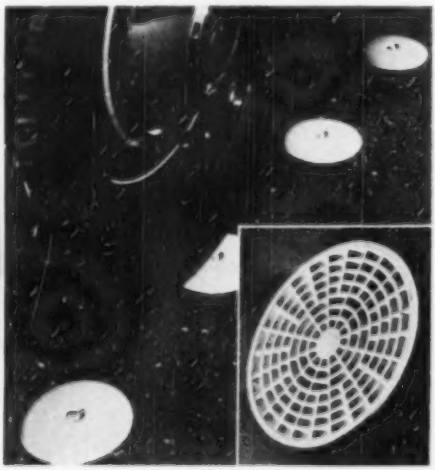
This is only the beginning, the vacuum experts say. An instant coffee concentrated the same way as orange juice (but dried to a powder instead of frozen) is already on sale in a few stores. The makers claim it tastes almost exactly the same as fresh coffee. Milk—which is 87 percent water—is another food the researchers are trying to concentrate in this way.

And the drugstore shelves may soon hold a host of new products that owe their existence to high vacuum—vitamin complexes, vaccines, hormones, and a combination of amino-acid chemicals that might be used instead of blood plasma.

Another process is vacuum impregnation, which forces fillers into the pores of materials under vacuum. Already used to eliminate porosity in metal castings, it is being tested for dyeing new synthetic fabrics that don't dye well by ordinary methods and for impregnating leather to resist scuffing.

And still other new things are on the way. More and more industries are discovering what the laboratory people knew years ago—you can really make a lot out of "nothing." END

## Disks Mark Traffic Lanes



MORE durable and easier to apply than paint to asphalt or concrete, a new traffic-lane marker made of Tenite® plastic has been developed by the Traffic Safety Supply Co., of Portland, Ore. The disks, 4½ inches in diameter, have a convex top and a flat bottom with waffle-type ribbing (inset) for strength. Colors are white and yellow.

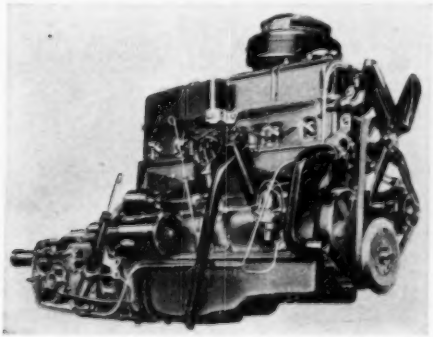
## Making World's Biggest Hose

COPPERIZED ⅝-in. steel wire for reinforcement is shown being wrapped around a 20-foot length of hose weighing more than four tons. Made of 15 plies of rubberized fabric, the hose is 38 inches in diameter. The grandaddy sand-suction and discharge hose, made by the Goodyear Tire and Rubber Co., will be used on Mississippi dredges.

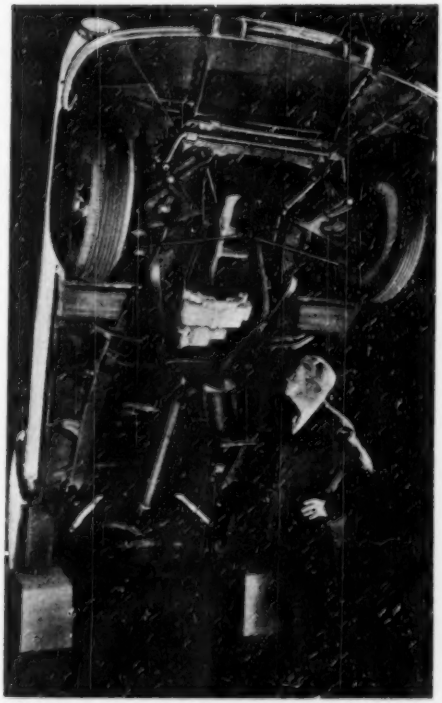
**A six-passenger hard-top coupe that looks like a convertible is new on Chevrolet's 1950 line.**

# Chevvy Gets a Torque Converter

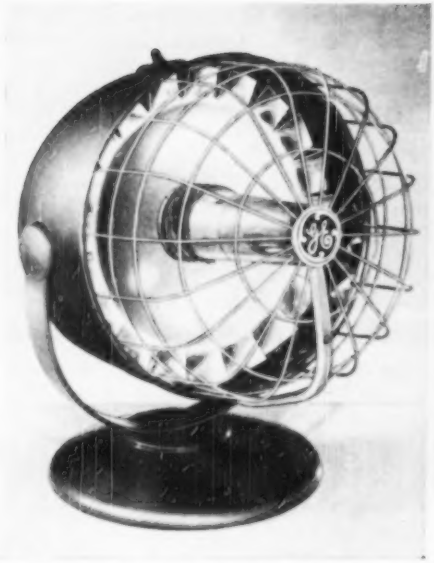
LONG-RUMORED in the car industry, a Chevrolet with an automatic transmission as optional equipment was announced last month as the company's bid to retain the car's lead sales position in the low-priced field. An adaptation of Buick's Dynaflow, the Chevrolet torque converter is called "Powerglide." Unlike some simple torque converters, it does not allow the car to free-wheel when the driver takes his foot from the accelerator. Styling for 1950 follows the general pattern laid down last year. Added to the line is the Bel-Air (above), a hard-top job resembling a convertible.



**New valve-in-head engine** develops 105 hp. for use with Powerglide, 15 hp. more than former engine. Displacement is 235.5 cubic inches; bore, 3 9/16ths; stroke, 3 15/16ths. Smaller engine of 92 hp. is used with gearshift models.



**Chief engineer** for Chevrolet, Edward H. Kelley, looks at installation of new automatic transmission, shown in white on car's underside. New way of manufacturing torque converter made possible its application to GM's low-priced car.



## Heater Has Rotating Reflector

THIS portable GE heater has a polished aluminum reflector that doubles as a low-speed fan. A motor switch provides a choice of either radiant or radiant and forced-air heat. Suspended from a U-shaped bracket, the appliance throws heat at any angle from vertical down. For use on 120-volt AC, it is rated at 1,320 watts.

## Gloves Stop Heat or Cold

WHEN an industrial worker wears the waterproof gloves above, he can put his hands into liquids as hot as 314° F. and as cold as 85° below zero. Made of red neoprene by the Pioneer Rubber Co., of Willard, O., the hand protectors have curved fingers and cover the wrists. They are insulated with layers of wool fleece.

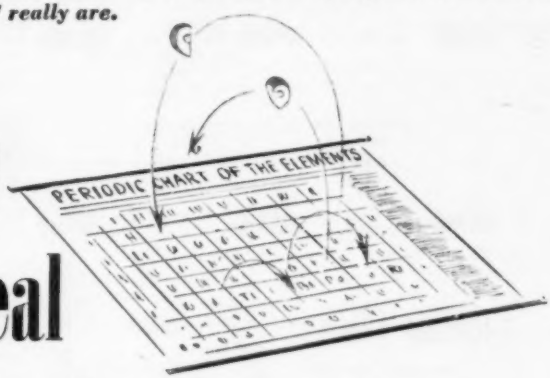
## Plastic Tot Tub Blows Up

A BATHTUB for Junior is only one of the uses for the Koroseal® container above. Convenient also for carrying laundry, or holding the baby in an auto, the basket has three mouth-inflated parallel tubes on its sides. Measuring 6 by 12 by 26 inches, it retails for about $4 and is made by Ideal Novelty and Toy Co., of Hollis, N. Y.

## Paper Clip Holds Tight

THE simple but tenacious paper clip above won't let papers slip from a thick pile of correspondence. According to the inventor, Forest J. Neel, of Louisville, Ky., the fastener is grooved and tongued in such a way as to increase its resiliency and give a greater holding surface. It is 2½ inches long and ½ inch wide.

***Like jumping beans, atoms of the radioactive families hop about the periodic table of elements as they change spontaneously from one substance into another. Recent discoveries link atom-bomb ingredients and newly discovered elements to these radioactive families—and solve the riddle of what such oddly named members as Uranium $X_2$ and Radium C′ really are.***




# New Atomic Charts Reveal Secrets of Radio-Elements

***By Alden P. Armagnac***

*A whole new radioactive series, the Neptunium Family, has been discovered. Important branches, including six newly found elements, have been added to the "family trees" of the three series known before. Practical uses for the new data are as spectacular as in making plutonium for atom bombs—a process to which a formerly unknown branch of the Actinium Family supplied the key.*

*Atomic-age discoveries described in this article have been happening too fast for the chemistry and physics books to keep up. Radioactive-family charts in standard works of reference are now superseded by new ones from the AEC, summarizing all the latest information, and reproduced here for the first time in popular form.*

SOME day soon, a brand-new chemical element seems likely to be added to the 96 now known. Like astronomers training their telescopes on the predicted position of a new planet, chemists seeking it have considerable advance information to go on.

The predicted new element will be radioactive. Its atomic number of 97 will top that of curium, a violently radioactive element that concludes the present list as No. 96. Its isotope or variety of mass 243 will be formed from curium of the same mass, by natural radioactive transmutation or "decay," and will emit alpha rays. It will change successively into more than a dozen other substances, including uranium 235 of atom-bomb fame, and wind up as stable lead.

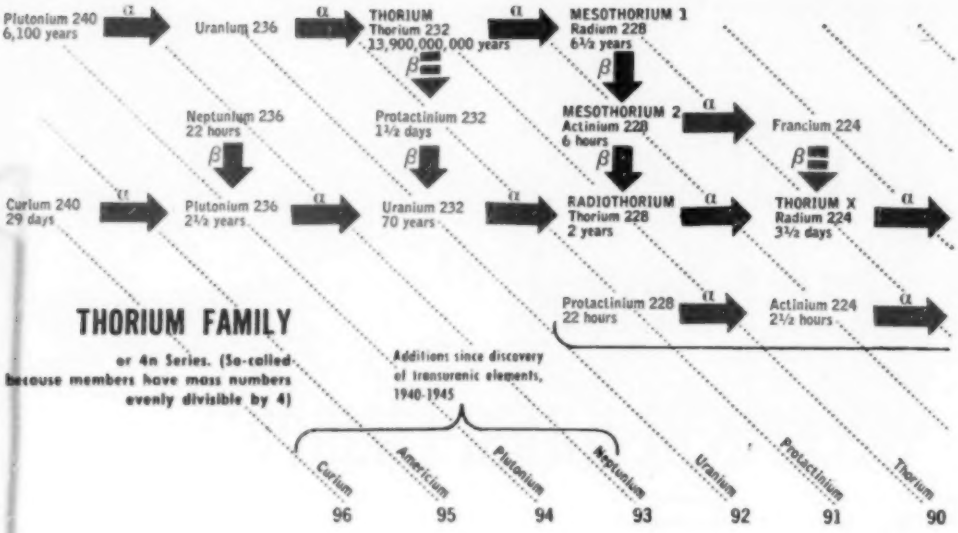
This is just one of the revelations of a new set of charts of the radioactive families of elements just released by the U. S. Atomic Energy Commission from its "classified" or secret list. They were compiled by Dr. Karl Z. Morgan, director, Mrs. Virginia K. Patterson, junior physicist, and Dr. Forrest Western, associate director, of the Health Physics Division, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Modernizing the classical "family trees" of uranium, radium, and the rest of the radio-elements, the four atomic-age charts of the AEC set incorporate the latest discoveries. They contain so much new information that they render obsolete all earlier ones in textbooks and encyclopedias.

Because of their lively news interest and permanent value for reference, the complete set of AEC charts is reproduced on pages 144-45 and 148-49. POPULAR SCIENCE has rearranged them for convenience in reading, inserted both old and new names in full, and added profuse descriptive notes from the original scientific reports

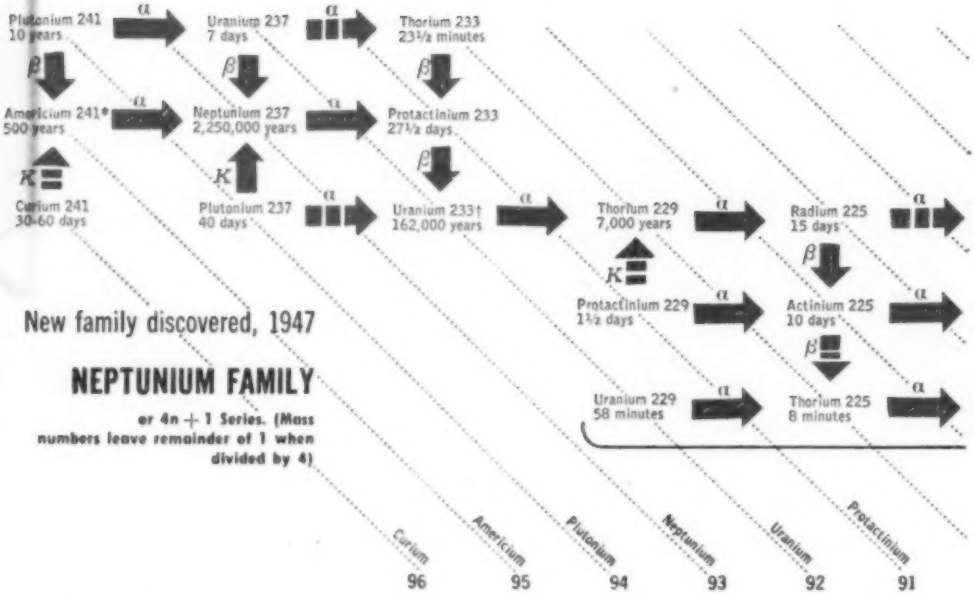
POPULAR SCIENCE Monthly

# New Radioactive-Family Charts




## THORIUM FAMILY

**or 4n Series. (So-called because members have mass numbers evenly divisible by 4)**




New family discovered, 1947

## NEPTUNIUM FAMILY

**or 4n + 1 Series. (Mass numbers leave remainder of 1 when divided by 4)**

## Key to All Charts *(New names and data appear in color)*

RADIUM A ...Old name (in capitals)
Polonium 218...Actual element and isotope
3 minutes ...Approximate half life, if known

**Black arrows** connect members of family formerly known

**Colored arrows** connect members of family recently discovered

**Broken arrows** connect possible family members, and show possible transformations, awaiting confirmation

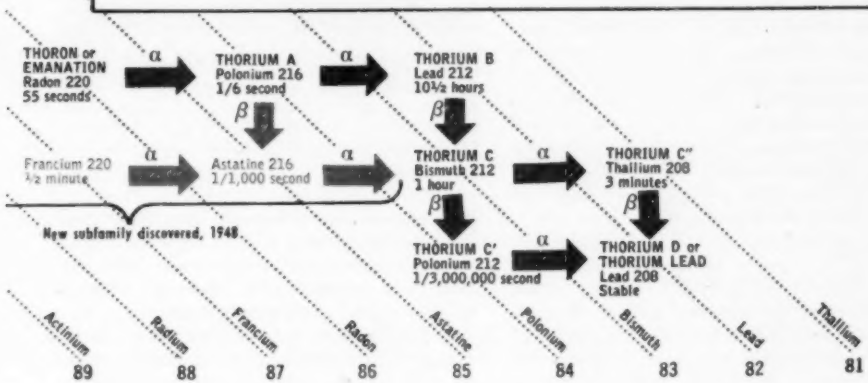
α **Alpha particle** emitted in transformation

β **Beta particle** (negative) emitted in transformation

K **Orbital electron** moves into nucleus in transformation

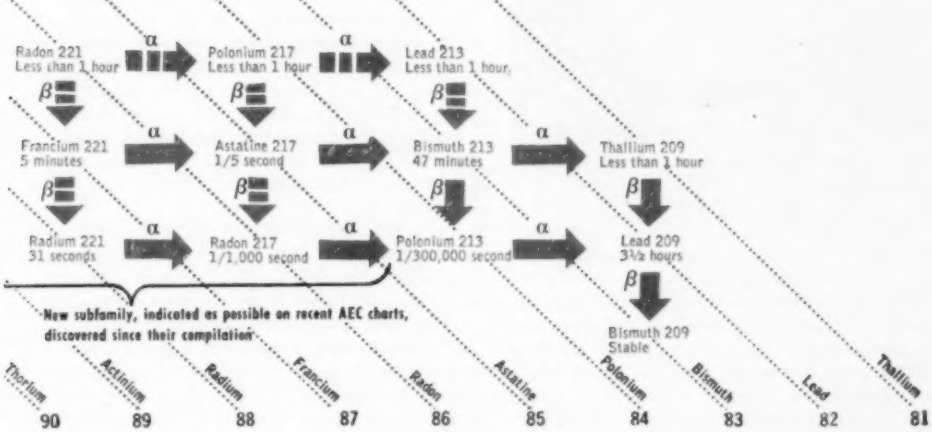
**Atom-bomb ingredients**

**Names** and **atomic numbers** of the radio-elements appear below charts. To find any element in chart, follow corresponding **diagonal line.**




"New element americium first discovered in this form, 1944-1945

†New fissionable material from thorium




*Charts continued on pages 148-149*

upon which the new AEC charts were based.

Reading left to right and top to bottom, each chart shows the succession of different products into which a substance like radium turns—usually emitting alpha or beta rays as it does so. Thus in the Uranium-Radium Family, radium itself first changes into radon, a heavy radioactive gas, and then into a series of other substances of which the last is nonradioactive and stable lead. Rounded figures show the approximate "half life" of each substance—the time required for half of it to turn into the next.

Three radioactive families have been known in the past—the Thorium Family, the Uranium-Radium Family, and the Actinium Family. As recently as 1947 a whole new one was discovered, the Neptunium Family, which ends in bismuth instead of lead as the other three do. All four families are portrayed by the new charts.

Here are some of their highlights:

### *Key to Atom Bomb Shown*

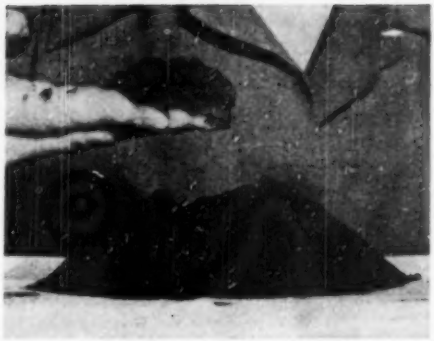
Making the atom bomb has been the outstanding practical application to date of their new data. The two most celebrated of all radioactive substances both appear on the modernized Actinium Family tree—uranium 235 and plutonium 239, the atom-bomb ingredients.

Earliest known member of this family, for which it was named, was once actinium. Then the family tree was traced farther

**AEC "declassified" document,** formerly secret, contains new atomic charts in skeleton form above. Pencil points to new fissionable material, uranium 233, abbreviated as symbol $U^{233}$.

back to "actino-uranium," old name for uranium 235. Now plutonium joins the family as a parent of uranium 235. Its own ancestry, as the chart shows, traces back to uranium 239.

This is the key fact applied at the AEC's great Hanford, Wash., plant to manufacture



**Textbooks saying** "Plutonium does not occur in nature" are behind the times. Secret war search, recently revealed, found natural plutonium in concentrate of pitchblende ore, above.

plutonium for atom bombs. In atomic piles there, bombardment with neutrons first converts natural uranium 238 artificially into short-lived uranium 239. Then nature takes its course, and plutonium results.

In April, 1948, the AEC officially classified as "fissionable" a third material, uranium 233 of the new Neptunium Family. Comparative abundance of its raw material, thorium, makes it especially interesting as a possible ingredient of A-bombs and source of atomic power. Its artificial manufacture resembles that of plutonium. Bombarding natural thorium 232 with neutrons converts it to thorium 233, which then turns into uranium 233 by the steps shown on the Neptunium Family chart.

Gather more than a critical quantity of an A-bomb ingredient in one place and a chain reaction produces an atomic explosion, whose atomic debris includes dozens of different elements. This cataclysmic possibility has overshadowed what otherwise and *normally* happens to plutonium 239 or uranium 235. By natural radioactive decay, over a long period of time, they turn into the products shown on their chart.

### *Six New Elements Charted*

Charts of all the radioactive families get a whole "new look" with discovery of family ancestors earlier than any known before and of new side branches in their lines of descendants. Six newly discovered chemical elements figure prominently in the recent additions.

The four "transuranic" elements discovered in the period 1940-1945—neptunium,

plutonium, americium, and curium—head the revamped family trees.

Other newcomers discovered in 1939-1940 are the elements francium and astatine, given names as recently as 1946 and 1947 respectively. A Frenchwoman, Mlle. Marguerite Perey, found francium to be a hitherto undetected, natural daughter of actinium 227; and it has subsequently been shown to be a member of other radioactive families. Astatine, first made synthetically in the University of California cyclotron, has attracted interest as a possible radioactive medical aid because, like iodine, it becomes concentrated in thyroid tissue.

### *"Natural" or "Artificial"?*

Are "artificial" family-tree members, born in the laboratory and sometimes unknown in nature, entitled to the same standing as old established "natural" members? With former distinctions between "natural" and "artificial" rapidly vanishing in modern science, the answer seems to be yes.

For one thing, modern alchemists with their atom-smashers have synthetically created many bona fide "natural" radioactive substances—among them, Radium E, Radium F, Actinium, Actinium X, and Actinium C′—which thereupon go through all their accustomed transformations. A gram of natural radium bombarded with neutrons recently yielded to Argonne National Laboratory experimenters, by artificial transmutation, the first substantial quantity ever available of pure "natural" actinium 227 for study of its chemical compounds.

**Miniature test tube** above holds tiny amount of purified curium, element No. 96. Violently radioactive, it glows with own light, and is most dangerous to handle of all radio-elements.

Conversely, supposedly "artificial" elements have now been found in nature too! One of the most hush-hush projects of World War II was a U. S. search to discover whether there were any ores from which plutonium for atom bombs could be mined. Although it failed to unearth usable quantities, it revealed that pitchblende and carnotite ores do contain traces of plutonium 239. Contrary to the statement that "plutonium does not occur in nature" in some textbooks published as recently as 1949, it has actually been proved a natural as well as an artificial element. Likewise, the "artificial" element astatine has now been found a natural member of the old radioactive families.

### *"Prehistoric" Family Re-Created?*

Discovery of the synthetic Neptunium Family raises an interesting conjecture along the same lines. Is this a prehistoric natural family, now extinct except in the laboratory? Its longest-lived member known, neptunium 237, has a half life of 2¼ million years. This is short by comparison with the half lives of the longest-lived members of other families, and with the estimated two-billion-year age of the earth. Thus all the known Neptunium Family members might have once existed on earth and now vanished.

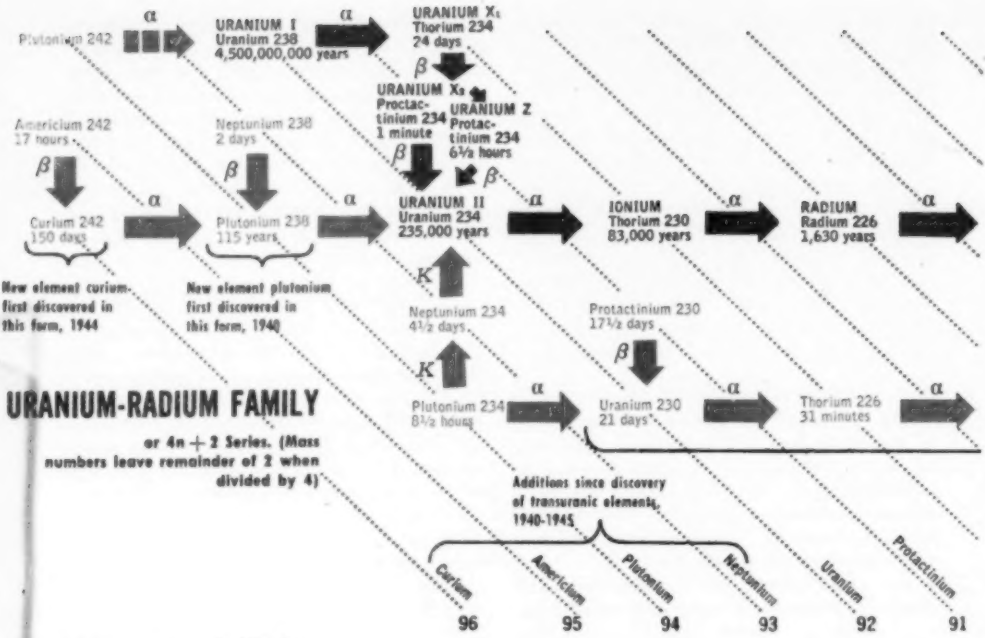
If this is so, how could natural plutonium 239 survive, with its comparatively short half life of 24,400 years? The proposed answer is that natural uranium in ores bombards itself with neutrons, constantly creating plutonium anew.

### *Isotopes Solve Old Mystery*

What are Uranium $X_1$, Radium E, and Actinium C′? They're *not* uranium, radium, or actinium. Today, chemists know they're thorium, bismuth, and polonium, of mass 234, 210, and 211 respectively.

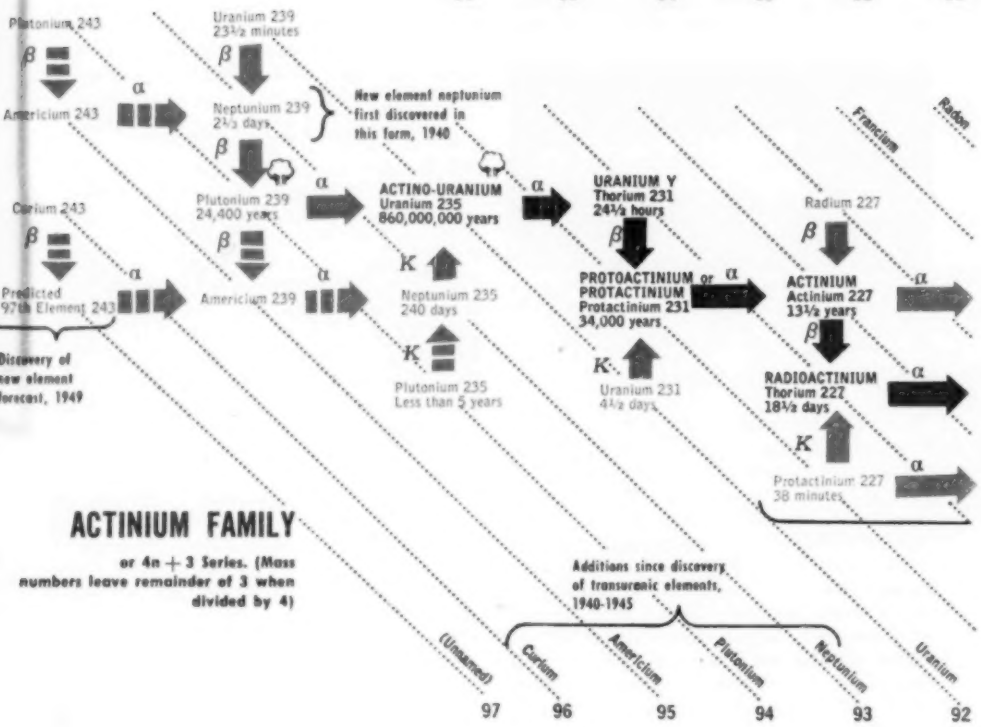
These misleading old-fashioned names, adorned with letters from A to Z, subscripts, Roman and Arabic numerals, and primes and double-primes, date from the days before puzzled chemists understood what radioactive-family members were. By such tests as atomic weight, they seemed to differ mysteriously from all known elements.

Modern discovery that they're actually isotopes, or light and heavy varieties, of familiar elements brings order out of chaos. The name of an element and the number of its isotope positively identify 112 of those charted here. The remaining two, easily distinguished by different half lives, are twin forms or "isomers" of the same isotope, protactinium 234. The whole 114 fit like jigsaw-puzzle pieces into a beautifully systematic picture, as will all new ones discovered in the future.



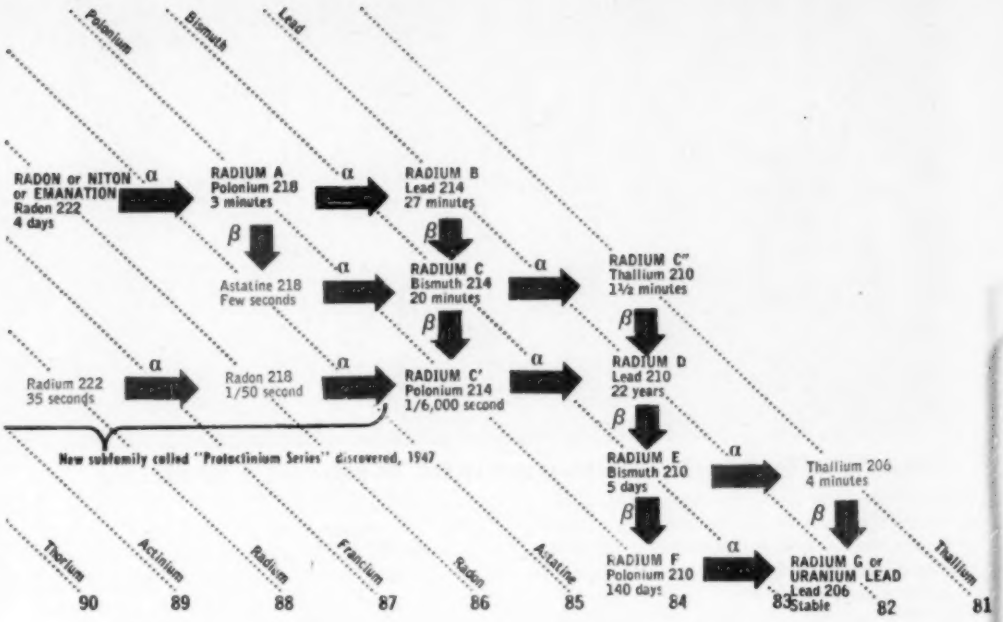

# URANIUM-RADIUM FAMILY

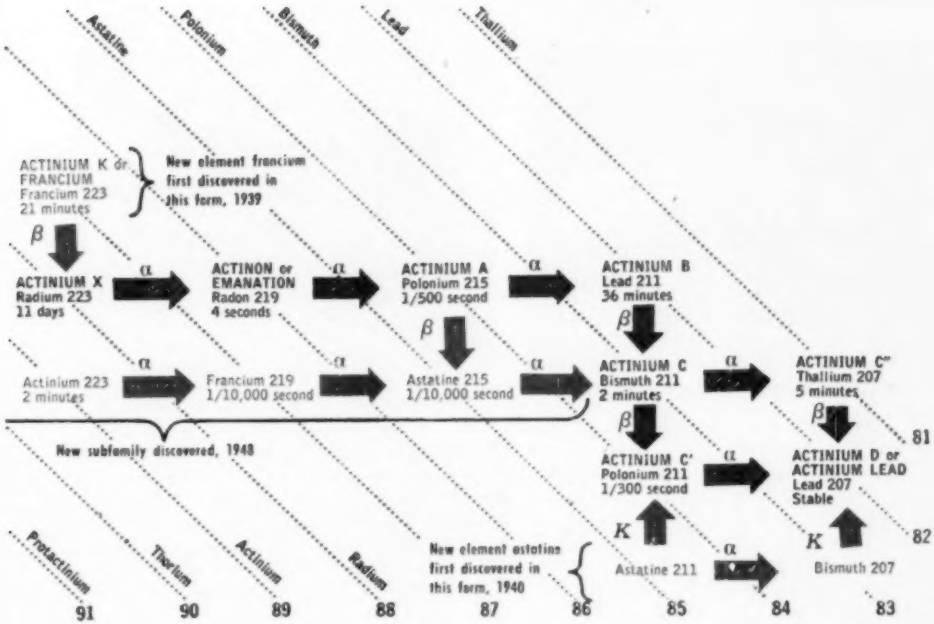
**or 4n + 2 Series. (Mass numbers leave remainder of 2 when divided by 4)**

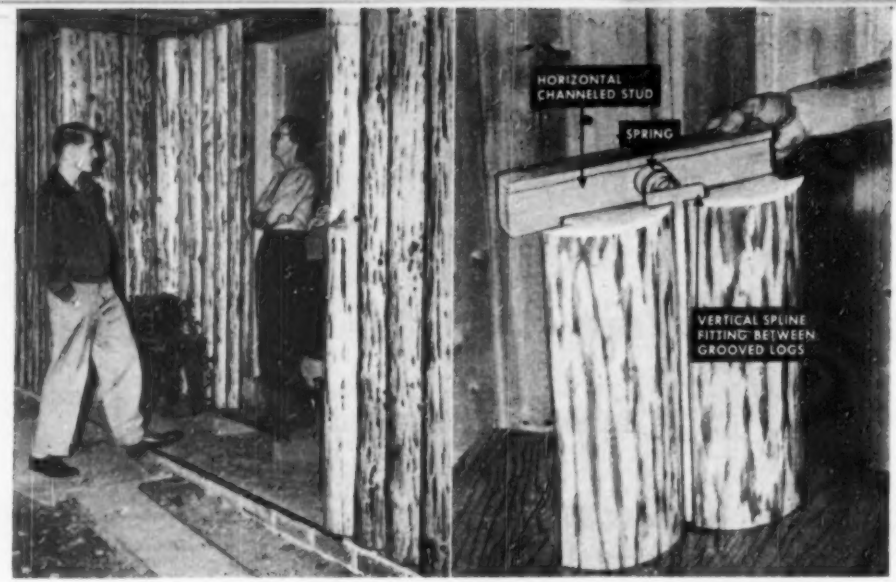



# ACTINIUM FAMILY

**or 4n + 3 Series. (Mass numbers leave remainder of 3 when divided by 4)**


Polonium
Bismuth
Lead
RADON or NITON or EMANATION Radon 222 4 days
α
RADIUM A Polonium 218 3 minutes
α
RADIUM B Lead 214 27 minutes
β
Astatine 218 Few seconds
α
RADIUM C Bismuth 214 20 minutes
α
RADIUM C" Thallium 210 1½ minutes
β
Radium 222 35 seconds
α
Radon 218 1/50 second
α
RADIUM C' Polonium 214 1/6,000 second
α
RADIUM D Lead 210 22 years
β
New subfamily called "Protactinium Series" discovered, 1947
RADIUM E Bismuth 210 5 days
α
Thallium 206 4 minutes
β
Thorium
Actinium
Radium
Francium
Radon
Astatine
Thallium
RADIUM F Polonium 210 140 days
α
RADIUM G or URANIUM LEAD Lead 206 Stable
90
89
88
87
86
85
84
83
82
81

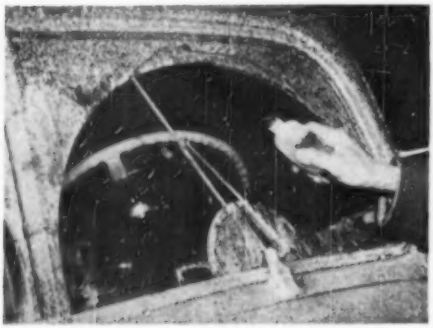

Astatine
Polonium
Bismuth
Lead
Thallium
ACTINIUM K or FRANCIUM Francium 223 21 minutes
New element francium first discovered in this form, 1939
β
ACTINIUM X Radium 223 11 days
α
ACTINON or EMANATION Radon 219 4 seconds
α
ACTINIUM A Polonium 215 1/500 second
α
ACTINIUM B Lead 211 36 minutes
β
Actinium 223 2 minutes
α
Francium 219 1/10,000 second
α
Astatine 215 1/10,000 second
α
ACTINIUM C Bismuth 211 2 minutes
α
ACTINIUM C" Thallium 207 5 minutes
β
New subfamily discovered, 1948
β
ACTINIUM C' Polonium 211 1/300 second
α
ACTINIUM D or ACTINIUM LEAD Lead 207 Stable
K
K
Protactinium
Thorium
Actinium
Radium
New element astatine first discovered in this form, 1940
Astatine 211
α
Bismuth 207
91
90
89
88
87
86
85
84
83
81
82




## Log Walls Made Weathertight Without Chinking

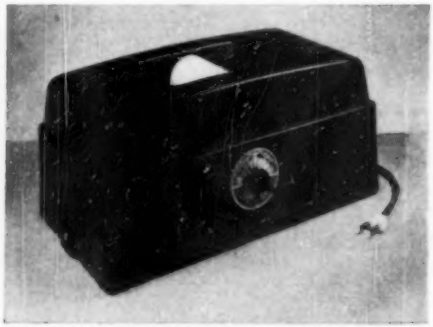
THE tedious and expensive chinking of log walls that has made them impractical for homes and business structures has been eliminated by a mechanical joint that provides protection against wind, rain, and snow.

In a method developed and patented by Robert Jonsrud of the Jonsrud Log House Co., of Sandy, Oregon, rabbeted half-logs in a vertical position are joined together by splines that take the place of chinking, as shown in detail in the photo at right above. Instead of conventional studding, the backing on the inside of the wall consists of horizontal studs that are channeled to hold galvanized spiral springs against the splines, pressing them firmly against the rabbets in the logs. The spring action keeps the joints tight, regardless of any shrinking or swelling caused by extremes of weather. The photo at left shows how the walls look outside.



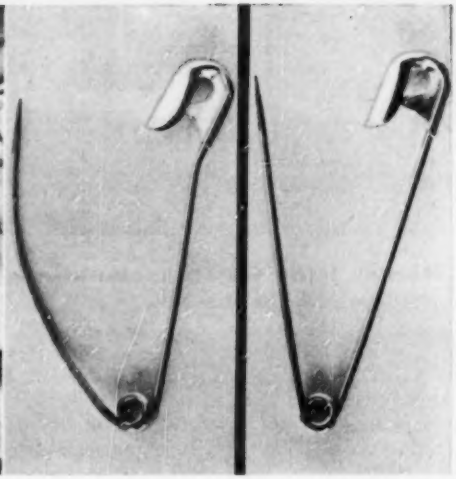
### Atomizer Sprays Ice Away

DE-ICING fluid is packaged in a flexible, nonbreakable atomizer bottle to make the clearing of sleet and snow from windshields and car windows easy. Squeezing the bottle with a pulsating action forces the liquid out of the atomizer in a fine spray. The liquid turns snow and ice to a slush the wiper blades can handle. Made by Birma Mfg. Co., Buffalo, the de-icer sells for about $1.



### Vapor Machine Kills Viruses

AIR-BORNE diseases in the office, home, or nursery may be cut down by this air purifier that looks like a table radio. As a roll of impregnated paper passes over a heating element, it releases triethylene glycol vapor, destroying viruses that cause respiratory infections. A dial on the plastic cabinet regulates the amount of vapor produced. It is made by Air Purification Service, Newark, N. J.

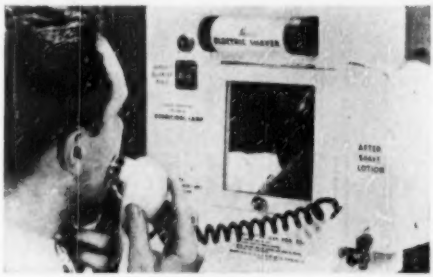


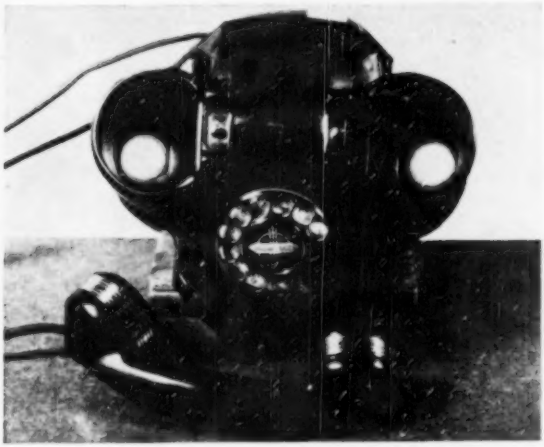
## Baby Pinned Painlessly

A DIAPER pin with a safety curve, shown above in use and contrasted with an ordinary safety pin, may reduce anguished cries from the nursery. Father of the "scoopin," and of a baby girl who inspired it, is Dr. Bruce R. Vent, of Lagrange, Ind. He claims his pin turns the point away from the baby during pinning and holds larger folds of cloth.

## Coin Operates Shaver

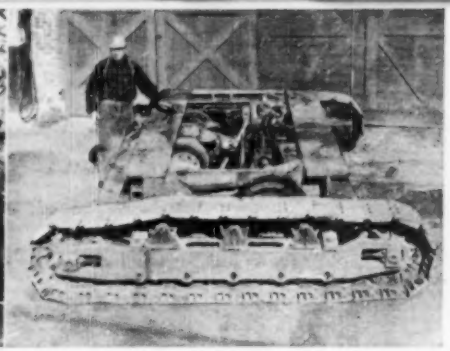
A QUARTER in the slot of this wall unit, designed for installation in rest rooms, gives you the use of a Norelco electric shaver for six minutes, and a teaspoonful of after-shave lotion when you are through. When the razor is not in use, it fits in a cabinet behind the mirror and is bathed by a germicidal lamp that shines through for display purposes. A burglar alarm discourages razor robbers. The shaver empties and sharpens itself.



## Small Ultraviolet Lamps Kill Germs in Phone Handset

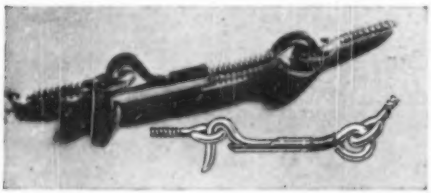
THE phone bugs won't get you with this Sterl-A-Fone®, which destroys harmful micro-organisms in both the mouthpiece and earpiece in a few seconds after a phone is cradled. As shown in the photo at left, the device consists of a hollow platform on which the telephone-instrument base is mounted. This contains the electrical connection to light the two 3½-watt germicidal lamps seen at the bottom of the cylindrical shields at each side. When the telephone handset is replaced after use, its weight automatically trips a switch, lighting the ultraviolet lamps that burn for about 30 seconds. The life of the sterilizing lamps is estimated at 20 years in normal use.



## Homes Ride on Housemobile

HOUSES are whisked from one site to another by the self-propelled "housemobile" above. Ernest Hugentobler, a rigger, of Little Ferry, N. J., built it from spare parts of cars, motorcycles, and planes in a year and a half's spare time. Besides saving time and labor, he says, it avoids the risk of damaging a house in pulling it on timbers. It carries a load of 150 to 250 tons at a speed ranging from 90 up to 2,500 feet per hour. A trailer truck easily transports it to a job.

The 15-ton housemobile, pictured at right above, measures 11 feet long and 18 feet wide. Operated by remote control with compressed air hoses and valves, it has a body of steel beams and a 73-hp. marine engine. It runs on 20-inch treads made for a 50-ton crane. Cars furnished its radiator, transmission, and drive shaft. A plane's automatic pilot controls its clutch. At left above, it is moving a Lincoln Park, N. J., bungalow along a highway, where its speed minimizes interference with traffic, under the control of the operator walking alongside.

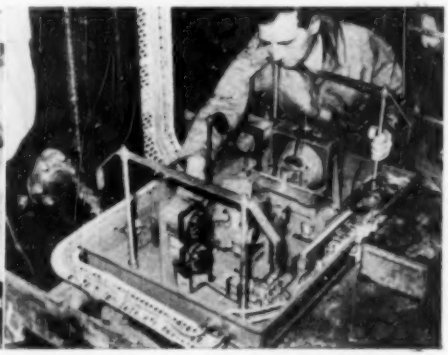


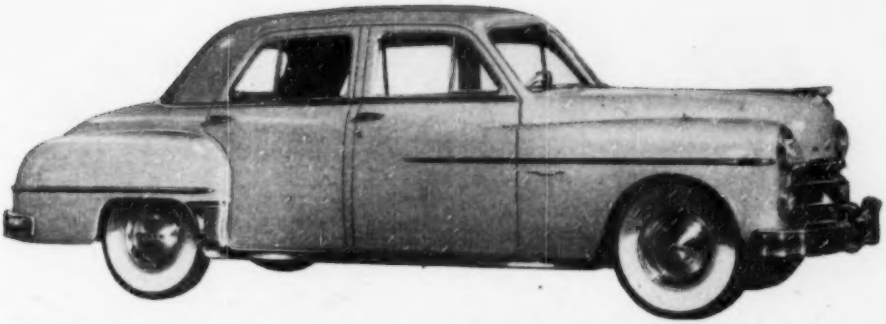
## Safety Hook Has Lock

FASTEN a window screen with this Lawler safety hook, and a small child can't unhook it and fall out. It has a locking slide, drawn back against a spring (inset) to release it. Made in two sizes, it also locks stair gates and screen doors.

# Ship's Anti-Roll Fins Turn Rough Water to Smooth

EXPECTED to prove a boon to passengers subject to seasickness, stabilizer fins of recent British invention have been fitted to the cross-Channel vessel *Invicta* to keep her on an even keel in heavy weather. Projecting from the hull's sides as at left, below, the movable fins are automatically operated by the control unit shown in the other view, which works like a plane's gyro-pilot. When the ship starts to roll or pitch, spinning rotors of vertical and horizontal gyros maintain their original positions, and the relative motion of their frames actuates mechanism that tilts the fins just enough to right the vessel.

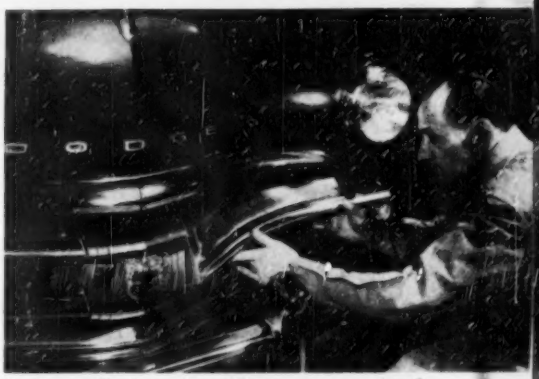




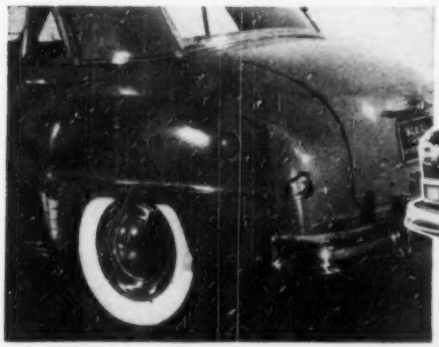
**New Dodge Coronet has 123½-inch wheelbase. New cylinder processing cuts break-in time.**

# *Chrysler Lines Get Restyling*

NEW lines of De Soto, Plymouth, and Dodge cars, resembling their 1949 predecessors but restyled to give them a longer, lower appearance, were announced by the Chrysler Corp. at the turn of the year. Dodge offered its Gyro-Matic semi-automatic transmission at a cost described as lower than competitive automatic transmissions. Plymouth widened its front and rear treads, has a 97-hp. engine of 7-to-1 compression ratio, and sports huskier bumpers.

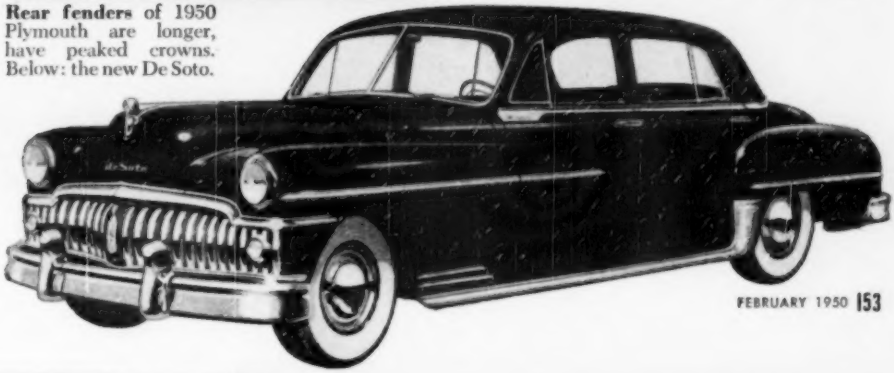


**Dodge grille is replaceable** in sections. Cowl, side panels are insulated with rubber, jute.



**Rear fenders** of 1950 Plymouth are longer, have peaked crowns. Below: the new De Soto.

**Special DeLuxe** Plymouth sedan is one of nine body styles. Rear window has new rubber seal.



**Fog-dispensing truck** has 12 nozzles, six to a side under catwalks, that can produce either spray or straight streams. In addition, men on catwalks can fight fire with hand fog guns.

# Fire Chief Builds Engine To Fight Brush Fires

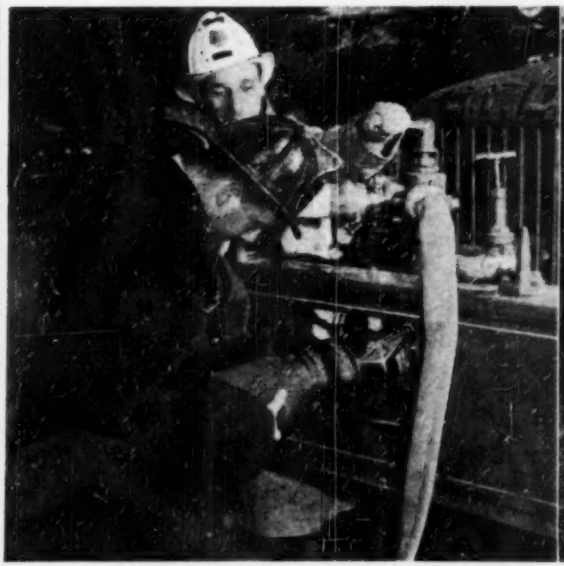
**Safety belt** connected to sturdy rail on top of truck frees fireman's hands so he can use fog gun while truck moves rapidly through fire. Truck's 817-gal. tank can be filled from pond or stream.

**Dozen 5-gallon cans** equipped with hand pumps are carried on top. These are dispensed to firemen who are dropped off to fight fringe of fire as truck proceeds to fog out head of it.

**Fog streams shown above** protect crew and equipment if truck becomes encircled by fire—an ever-present danger—eliminating the possibility that crew might be forced to abandon truck.

***PS photos by W. W. Morris***

BUILT on the chassis of a 2½-ton war-surplus Army truck, this homemade fire engine can crash right through dense brush and woods to fight runaway fires. High-pressure spray jets along the sides envelop the truck in a cloud of waterfog to protect its men and equipment while it roars in to attack the head of a fire. A beefed-up, battering-ram bumper permits the six-wheel-drive truck to bowl over five-inch trees. The truck was built by ex-Fire Chief Louis Maas for the Brentwood, N. Y., Fire Dept.



**Where hydrant is available,** hose coupling in bumper aperture takes standard 4-inch intake hose. Water can be discharged at 200-lb. pressure through one 1½-inch and one 2½-inch nozzles.

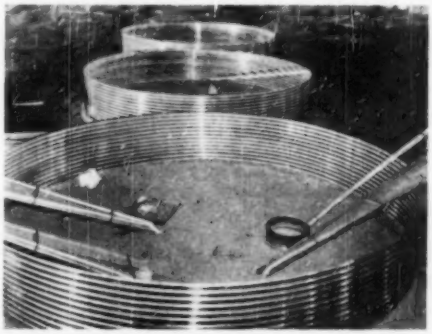
**Truck's heavy bumper** pushed down this 5-inch tree in demonstration. Truck's ten speeds forward and two in reverse let it traverse practically any terrain. Slowest speed is about 2 m.p.h.

**With these quickly erected aluminum tanks, surplus grain was saved from weather damage.**

# *Raising the Roof Builds Bins Fast*

YOU start from the roof and work down in setting up these midget grain elevators. Made entirely of aluminum, they are assembled by fastening the roof sections to one "tier" of corrugated siding, lifting this unit and fastening another tier under it, and so on until the building is complete.

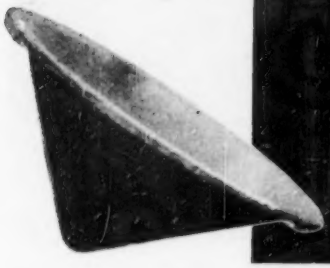
About 26,000 of the lightweight grain bins—these are at Enterprise, Iowa—were built last year to store surplus grain for the Government's Commodity Credit Corp. Butler Mfg. Co., Kansas City, and Beatrice Steel Tank Co., Beatrice, Neb., did the work.



**First step in construction** is placing of one "tier" on concrete footing that will serve as foundation when last section is in place. Completed, each bin holds 3,250 bushels of grain.

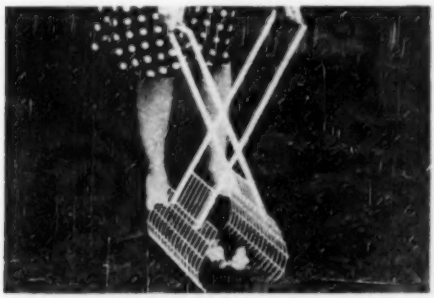
**Workmen can put on the roof** while standing on the ground. Roof is made up of pie-shaped aluminum wedges that dovetail together. Lightness of aluminum permits this unusual method.

**Now block and tackle** lift the tier and roof up into the air so that the second tier of siding can be fastened on. Building must be lifted by its bootstraps five times before it is finished.



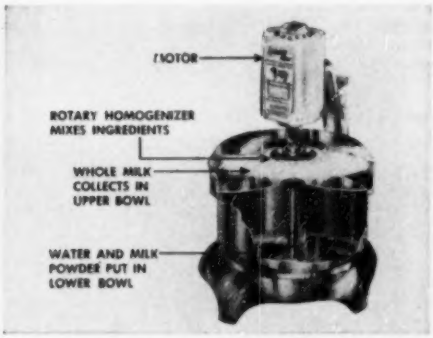
## Cones of Silence Soak Up Noise

SOUND absorbers developed at the RCA Laboratories, Princeton, N. J. have proved twice as effective in reducing noise levels as conventional acoustical materials. The photo at right above shows their installation in a woodworking workshop, where noise was reduced by 60 percent. The units, called "cones of silence," operate by forcing sound to travel through extremely narrow passages on the fuzzy surface of the cones, converting acoustic energy—noise—into heat energy. Consisting of two 14-inch cones (inset) clamped together, the wood-pulp units are suspended from wires. They can be used where pipes, skylights, crane rails, or lamps prevent conventional sound insulation.



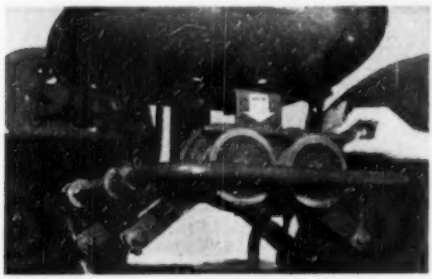
## Double Rake Nips Up Trash

THIS double-armed rake is intended to lessen back aches from stooping to pick up trash or leaves. Made of enameled steel, the tonglike device weighs only four pounds yet is strong enough to pick up stones as well as rubbish. The Grab-Rake® is made by L. M. Bussey, of Los Angeles.



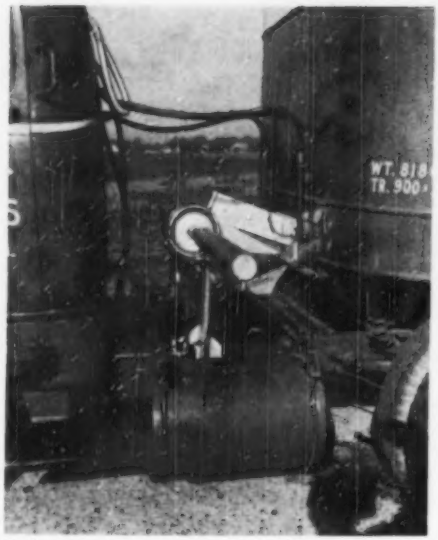

## Mechanical Cow Remakes Milk

THE Kitchen Kow®, above, recombines whole-milk powder and water into a beverage closely resembling natural fresh milk. Designed for home use, the small unit rehydrates, aerates, and homogenizes a quart in seven minutes. It uses less current than a 40-watt bulb. The device is made by the Star Metal Mfg. Co., of Philadelphia, Pa.



## Rubber Springs Soften Bumps

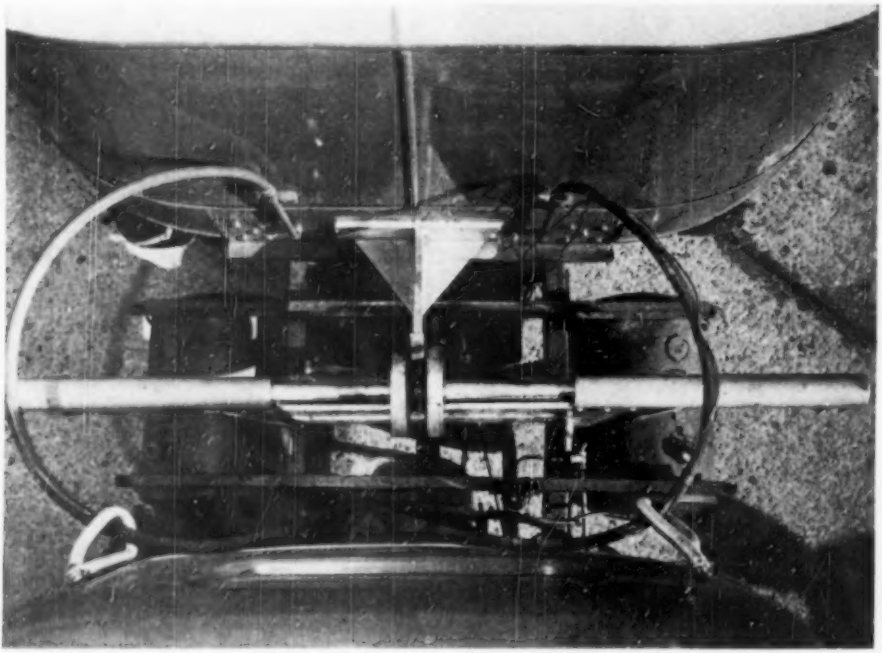
CYLINDRICAL rubber springs mounted as shown at left under a tractor seat are said to lessen driver fatigue and reduce rebound on jounces. Developed by the U. S. Rubber Co., the springs operate on a torsional-shear principle, twisting and turning with bumps. They can be adjusted to driver's weight.



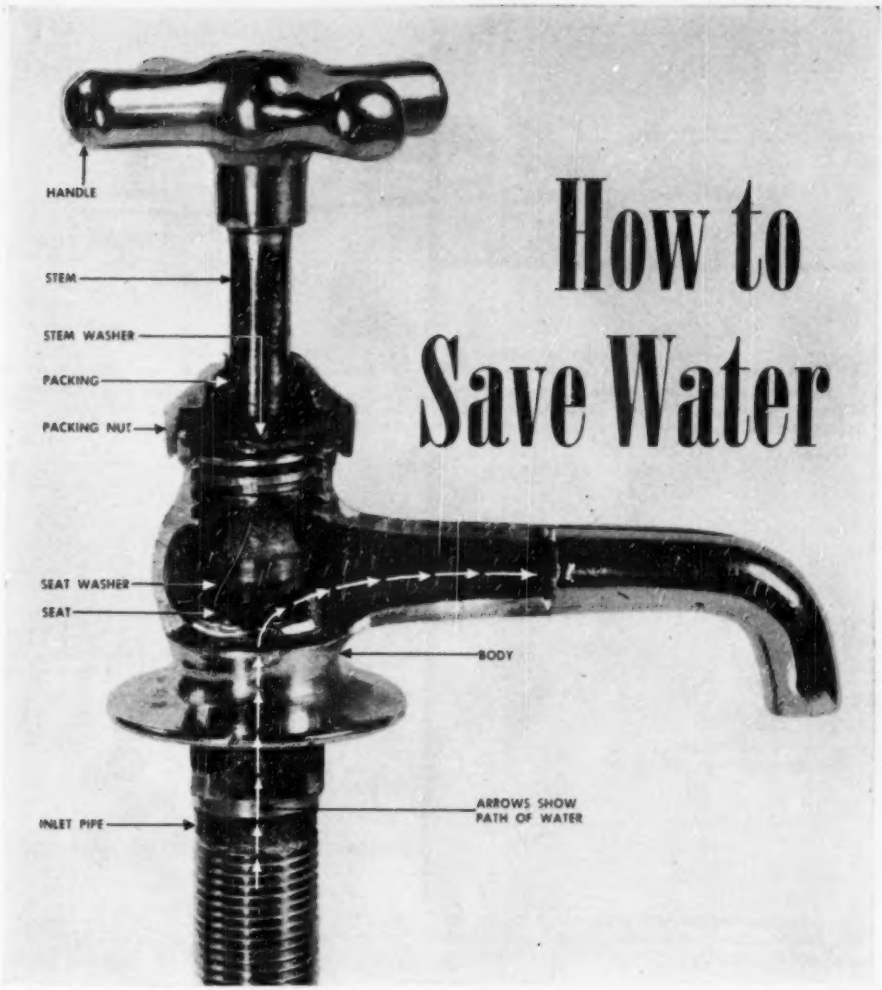

**Side view shows tongue** on trailer front inserted between two circular plates on tractor. Plates are on ends of plungers in two opposed cylinders. A dash control sets hydraulic pressure.

# New Truck Hitch Ends Jackknifing

A NEW hydraulic hinge for the front end of a truck trailer goes a long way toward minimizing that trucker's nightmare—jackknifing. Jackknifing occurs when the brakes are applied too hard on the tractor. The trailer, trying to overrun the tractor, whips off sideways. The Wakeman Stabilizer® shown here works as a damper to permit turning without sudden lash. It also can be used to lock tractor and trailer rigidly together if jackknifing threatens. Maker is Automatic Safety Devices, of Holly, Mich.



**Top view shows how tongue presses** against plate in a turn. Hydraulic fluid in cylinders opposes tendency of trailer to overswing on turn. Driver can lock hydraulic system by floor switch if he feels jackknife start. Normally cylinders allow gradual movement but resist sudden swings.




# How to Save Water

**A wrench, screwdriver, and reamer—those are all the weapons you need to fight water waste on the home front.**

***By Robert Hertzberg***

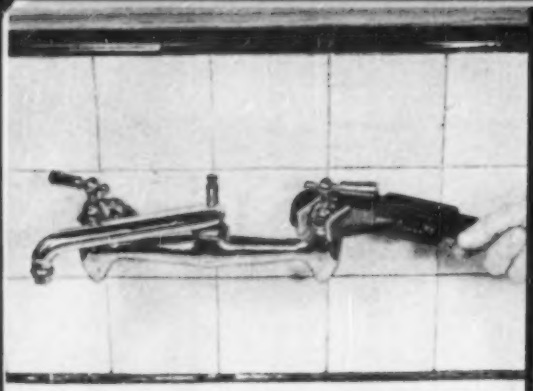
DRIP, drip, *drip*.

From leaking faucets in homes everywhere, millions of dollars of hard-earned tax money are daily going down the drain—literally. Even more important is the grim reality of dangerously low water supplies in many parts of the country as a result of last year's drought.

Water waste can be stopped, very easily, if every home owner will devote an hour some evening after supper to the various plumbing fixtures in his kitchen and bathroom.

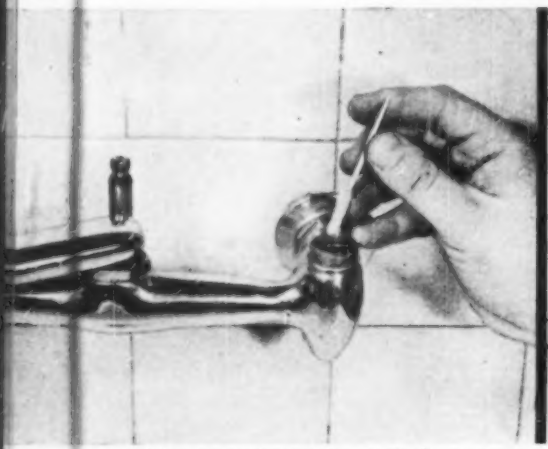
The wastage of water directly traceable to neglected sinks, bathtubs, showers, and toilets is staggering. In New York City, where the normal daily consumption is 1,200,000,000 gallons, the loss from wastage and faulty faucets has been estimated at about 200,000,000 gallons a day. That means a sixth of all the water the city consumes every day goes unused down the sewers!

But there's really not much to the job

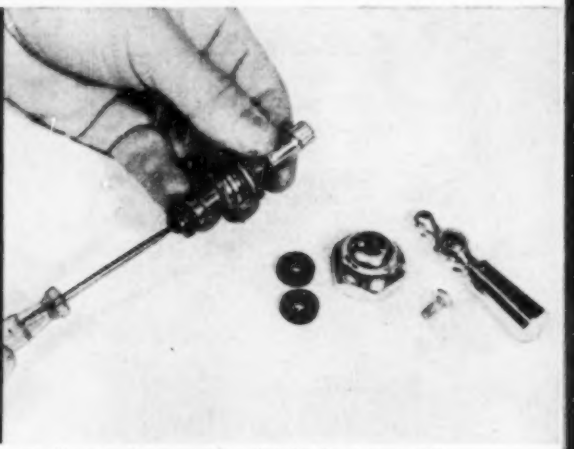


**1 First step in repairing** a leaky faucet is to remove packing nut with a monkey (not Stillson) wrench. Protect plated finish of the fixture with strips of wood or cardboard.

**2 Remove packing nut** and stem assembly by turning nut with fingers as it comes off the body. Let water from pipes drip out. Then examine seat inside the fixture for roughness.

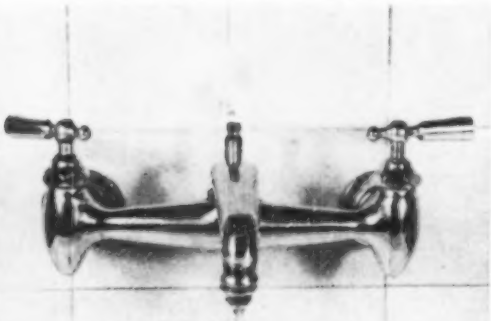


**5 After removing seating tool,** clean out cuttings inside faucet with cotton-tipped toothpick swab. Neglected brass shavings can shorten life of new washer and cause fresh leaks.



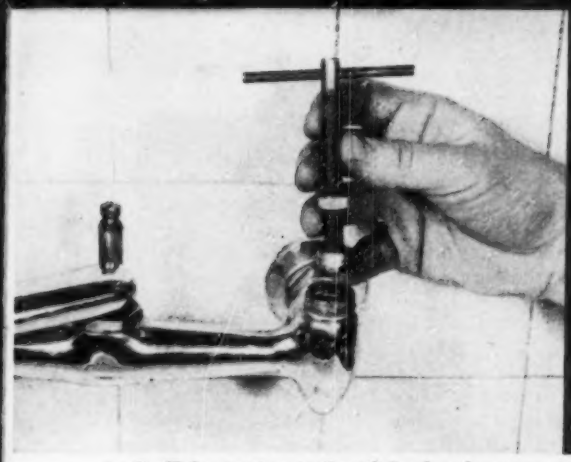
**6 New washer** must be of right diameter to fit recess in end of stem. Tighten screw just short of causing washer to become distorted. Loose washer can cause hammering noises.

**9 Here is the dripless faucet** that will save some 30 gallons of water a day from going wasted down the drain. An added dividend: You will get a smoother and more even flow.

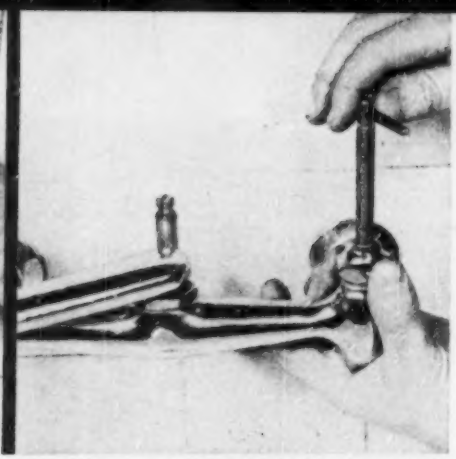


of fixing faucets. In the way of tools you need only a screwdriver, a monkey wrench opening to about two inches, and a little 39-cent reaming gadget, called a valve-seating tool, for smoothing off the washer seats inside the fixtures. Another 25 cents will buy a handful of new washers of assorted sizes.

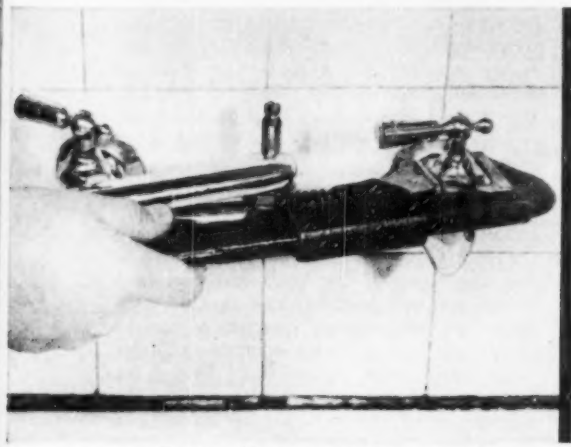
After shutting off the cut-off valve in the basement, open the basin taps in the bathroom and the taps in the kitchen to drain out the water in the pipes. This precaution will save you from a spurt of water in your face when you start disassembling the fau-



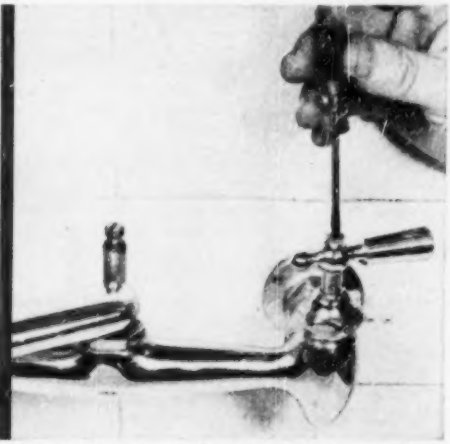
**3 Valve-seating tool,** with hardened cutter at lower end, fits in faucet in place of the regular stem assembly. It is sold in most hardware stores for less than half a dollar.



**4 Valve-seating tool** attached to faucet body with packing nut. Turn handle only two revolutions to loosen scale on the valve seat. Excessive turning may take off the whole seat.



**7 Reassemble faucet.** Make sure packing nut turns easily before applying wrench. The fine threads are easily upset. Adhesive tape can be used instead of wood to protect plated finish.

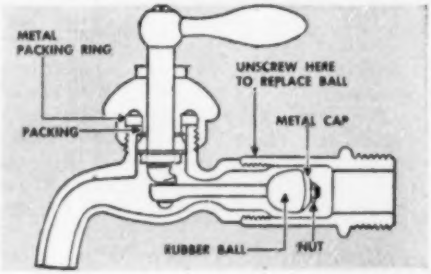


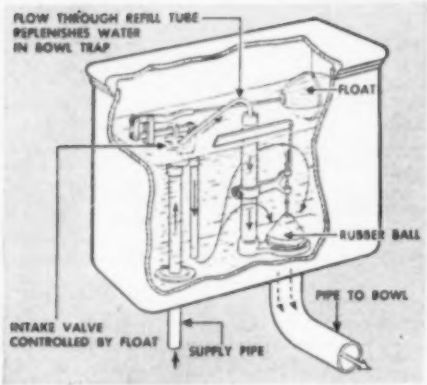
**8 New washer** will probably make handle of faucet assume different "off" position. Handle fits on splined end of stem and can be adjusted. Tightening of holding screw is last step.

cets in the kitchen or the basement laundry.

Most faucets used in homes are of the compression type. A typical one is shown in the cutaway photo on page 159. When the handle is turned down, a fiber or composition washer, about ⅛ inch thick, is pressed against the circular seat in the body. If the seat is smooth and the washer flat and pliable, the two make a watertight joint, and there is a feeling of softness or "give" to the handle when the flow of water stops. Since the brass body is hard and the washer soft and soaked, the latter will gradually shred away as the faucet is turned on ▶

**The Fuller-type faucet,** shown in drawing below, has a cone-shaped washer or ball fastened by a nut on the end of a short plunger rod. It can easily be replaced with a pair of pliers.





**The flush-tank toilet** may be a water waster because it has two control valves that can leak. Rubber ball at outlet is easily replaced by a new one. At left are shown the intake-valve parts.

and off. The first sign of danger is a feeling of "hardness" as you turn the handle, indicating that the washer has lost its ability to compress. This is the time to replace the washer.

The accompanying illustrations show the steps in repairing a kitchen faucet of the compression type. The same general procedure applies to bathtub, washtub, and shower fixtures and to old faucets of the "Fuller" type. The latter requires a cone-shaped washer that is fastened by a nut on the end of a short plunger rod.

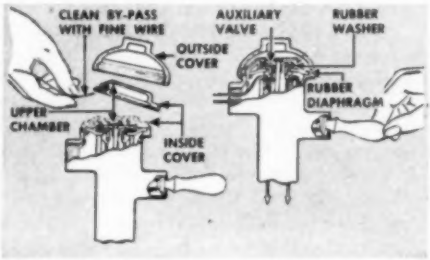
As long as the water is off anyway, disassemble and examine *all* the water fixtures in the house, not just the leaking ones. Washers are so cheap that you might as well put in a whole round of new ones.

Toilets of the flush-tank variety are notorious water wasters because they use *two* control valves, either or both of which may go bad. Also, because the entire brass mechanism is submerged in water, it accumulates greenish scum and slime through the reaction of the minerals and chemicals in the water on the copper component of the brass. These deposits may prevent the valves from seating tightly. In many cases, just cleaning the mechanism off with a rag and a soft brass brush will stop loss of water.

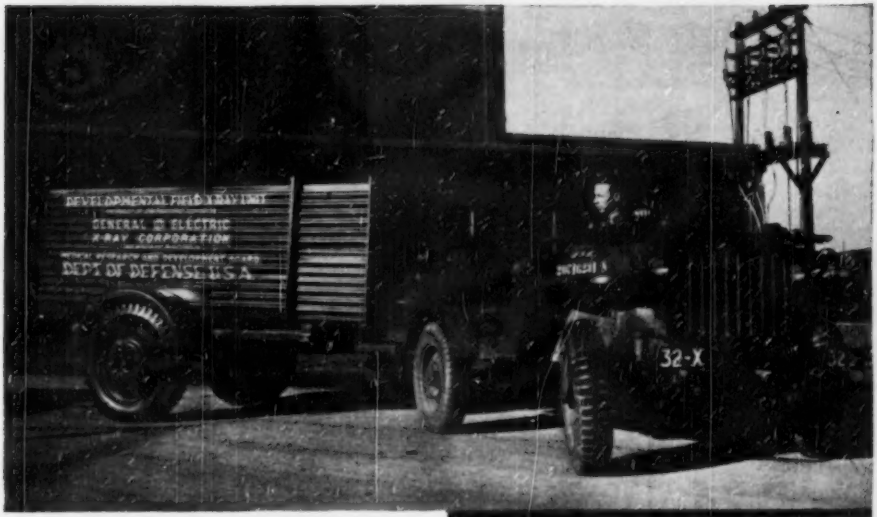
Of the two valves, the outlet is the likeliest offender. Usual point of trouble is the large rubber ball that is supposed to sit snugly over the open end of the pipe leading to the bowl. When it hardens or swells with age, it must be replaced. The slightest leak in the inlet valve will cause the water in the tank to overflow continuously through the center overflow pipe, even though the float ball is in its topmost position. The valve comes apart readily for inspection and repair. When it is seated properly, the water level should be about an inch below the top of the overflow pipe. With both valves in good condition, there should be absolutely no dribbling or gurgling of the water in the bowl itself.

In tankless-type toilets, known generally as "flushometers," the flushing cycle is controlled by a leather or rubber diaphragm. Although this diaphragm has a long life, the packing washer on the flushing handle takes considerable mechanical wear. All the necessary washers for a particular make of flushometer are usually sold as a package. It is a good idea to have a set on hand, because they may not be easy to find in an emergency.

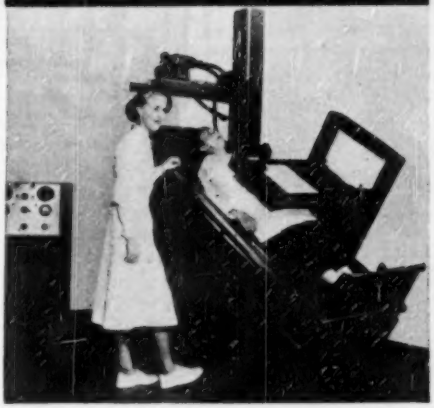
Excessive water pressure naturally aggravates leakage problems. If the water shoots out of your faucets like miniature geysers, try closing the main shut-off valve a turn or two at a time. If the house has flush-tank toilets, you will probably find that the only difference with reduced pressure is that the flush tanks take a minute or more to fill up. With flushometer toilets that depend on water pressure alone for their operation, the adjustment of the cut-off may be critical. If you live at the bottom of a valley and are getting a really strong head of water, consult your water company on the advisability of installing a pressure reducer. END




**Valve of the tankless-type toilet,** shown above, operates by water pressure alone. Moving the handle tilts an auxiliary valve that releases water pressure, starting the flushing cycle.



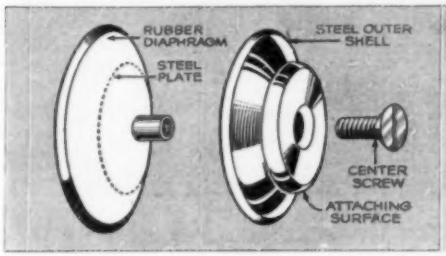

## Field X-Ray Unit Weighs Less



DESIGNED for use in combat areas, this portable X-ray machine has all conventional features, but weighs far less. A steel version tips the beam at 2,100 lb. and an aluminum one weighs only 1,600 lb.—compared to 3,000 lb. for comparable conventional models. It has a counterweighted tube assembly, a fluoroscopic unit, and a hydraulic drive that raises, lowers, or tilts the table. At right, a technician raises the table by pressing a foot pedal. The machine, developed by GE, fits in a waterproof, corrugated-metal container, shown above, which is buoyant enough to float. A heavy-duty transformer and rectifier supply 100,000-volt DC.

## Vacuum Cup Clings to Slippery Surfaces

Now you can permanently install fixtures on any smooth, impervious surface, thanks to a new vacuum cup that several manufacturers are fitting to their appliances. After the diaphragm is flattened against a surface, a screw threaded to an outer shell draws out a steel disk, giving increased "vacuum tension." At right, below, Screw-Vac® holds a pencil sharpener to a refrigerator. Van Dusen Engineering Co. developed the cup.



CONSTANT-VOLTAGE TRANSFORMER

FLUID REGULATORS

ALARM BELL

SPARK GUARD

CONTROL PANEL

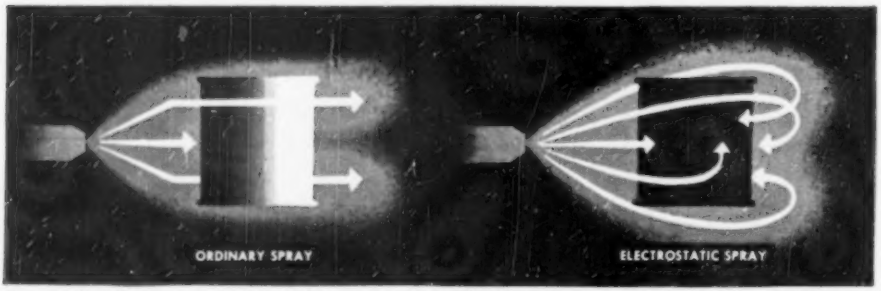
PAINT SUPPLY

SPRAY GUNS

WHEELS ENTER THROUGH BREAK IN WALL, TURN LEFT, AND PASS THROUGH ELECTROSTATIC FIELD

WIRE ELECTRODES

**Electrostatic spray-painting, visualized in drawing above, saves paint, requires fewer op-**




**Conventional spray-painting,** above, wastes paint through overspray, covers only one side. Electrostatic spray, right, wraps itself around the object. Relatively little paint is wasted.

**erators, and does a faster, more even job.**

# Electricity Aims Paint

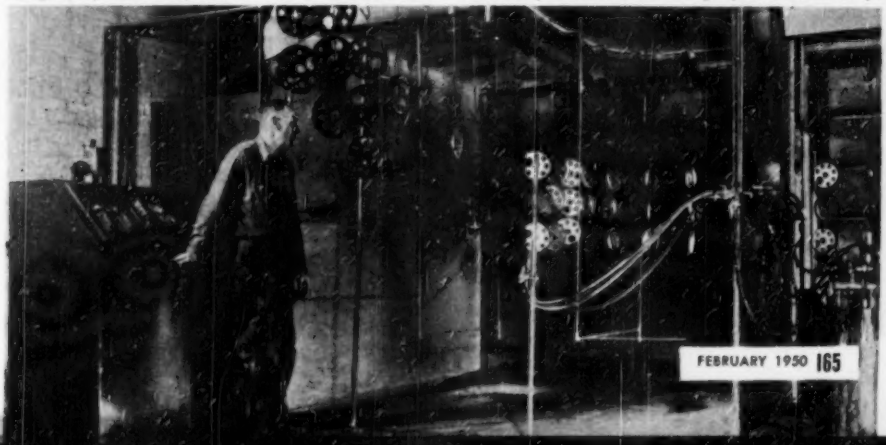
***By Herbert Johansen***

SPRAYING paint through a high-intensity electrostatic field now turns its atomized particles into a barrage of tiny "homing missiles" that literally wraps itself around objects to be painted. The drawing at left shows a setup for the process, called Electro-Spray, developed by the Ransburg Electro-Coating Corp., Indianapolis, during the war (PS, March '45, p. 118) and now used in many industries.

Standard 220-volt AC is fed into a high-voltage transformer, stepped up to approximately 100,000 volts, and changed to DC by a rectifying tube. The high potential charges a wire grid within the spray booth, creating an electrostatic field. Paint particles sprayed at comparatively low pressure into this field also become charged with the same polarity, opposite to that of the articles to be painted, which are grounded by the conveyer. The resultant attraction between paint and work is so great that many paint particles that blow past are pulled back to their target.

A special protective circuit prevents sparks and possible explosions. If excessive field current flows—as when a piece falls from the conveyer, or an electrode wire breaks—a thyratron-triggered "spark guard" cuts the high voltage and rings a bell. END

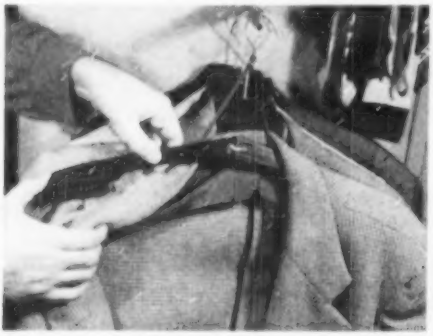
**"Wrap-around" action** makes it possible to hang many small objects, like the film reels below, from each hook in Christmas-tree style. Ordinarily each would be sprayed individually.



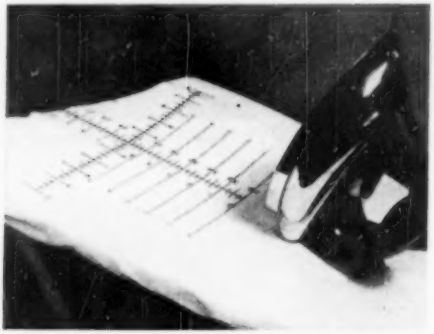
# Aids to Modern Living

**Tray Handles Three Jobs.** Molded of Bakelite®, this refreshment tray holds four glasses in non-tipping coasters and has space in the middle for snacks. And when the food's gone, that center space serves as a jumbo ash tray. Made by the Count-Rite Corp., of Cleveland, Ohio, the tray retails for about $1.50. Easy to clean, it can be rinsed and scrubbed without damaging it. Rubber pegs support the tray.

**Scissors Fold Up.** One of the first products to be imported from the U. S. zone of Germany, these scissors fold up for easy carrying in pocket or handbag. When closed, the tool is 2¾″ long; open it's 4″. The blades are made of carbon steel with a highly polished nickel finish. Hoffritz Cutlery, New York City, prices the scissors and case at about $3. When folded, the points cannot rip clothing or the lining of a purse.



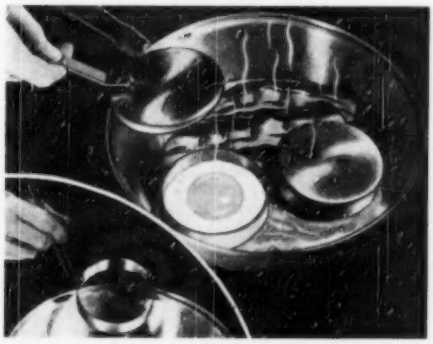
**Brush and Hanger Combined.** Besides folding up to save space in your suitcase, this coat hanger has a clothes brush at each end. The Rola Novelty Company, of New York City, sells the hanger for about 70 cents. When it's folded, the hanger arms serve as a handle for the brush. When opened as a hanger, a small hook locks it.



**Ironing-Board Cover Is Ruled.** With a graduated yardstick printed on this ironing-board cover, the housewife can do a professional job of altering hems, laying pleats, and blocking sweaters or other knitted garments. The figures are printed in ink that won't rub off. The maker is Hart-Beckner Mfg. Co., Versailles, Mo.

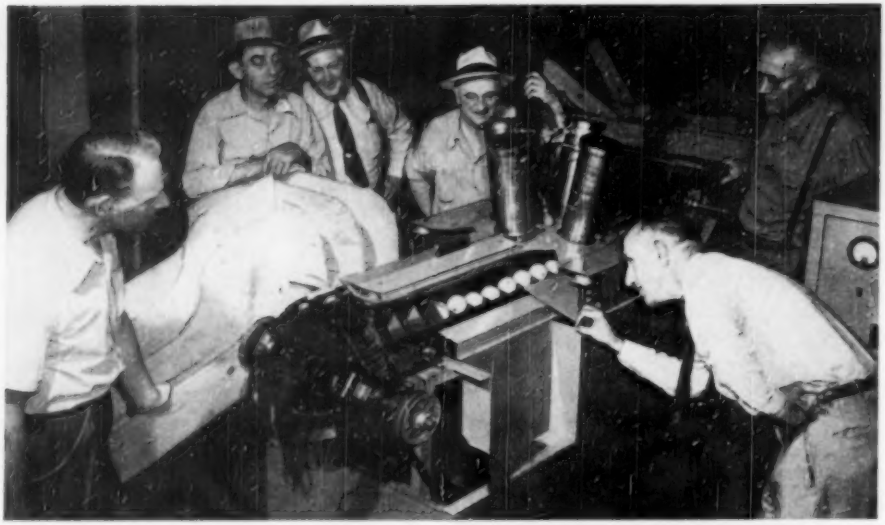
**Attachment Shampoos Rugs.** The Rexafoamer® shampoo attachment, sold by Martin-Parry Corp., Toledo, Ohio, is molded of Tenite®. It fits the spray-pot attachment of tank-type vacuum cleaners. A wire mesh in the nozzle mixes the liquid soap with air to form suds for washing rugs or upholstery. The plastic attachment is moisture-resistant and corrosion-proof. Its non-porous surface is easy to clean.

**New Table Lighter.** This lighter, for home or office, has a clear-plastic reservoir so you can always see the amount of fuel in reserve. It's priced at $7.50 by the Ritepoint Co., of St. Louis, Mo., and is available in four colors. The reservoir is sealed and cannot leak or let fuel evaporate. Fuel is transferred to the wick chamber only as needed by a finger-touch valve. All the metal parts are chrome-plated and polished.



**Frying Pan Accessory.** The Small Fry® set includes two 3½" aluminum rings that are ¾" deep, two aluminum covers, and a lifter. According to the makers, Benmatt Organization, Chicago, use of the rings to fry or poach eggs saves shortening and reduces cooking time. The rings leave room in the skillet for bacon. Price is $1.

**Rain Leggings.** Empire Products, New York City, markets these slip-on plastic leggings for $1. They fit over the lower part of your trouser legs, protecting them from rain and splashes. A clip slips over the edge of your pocket to hold them up.

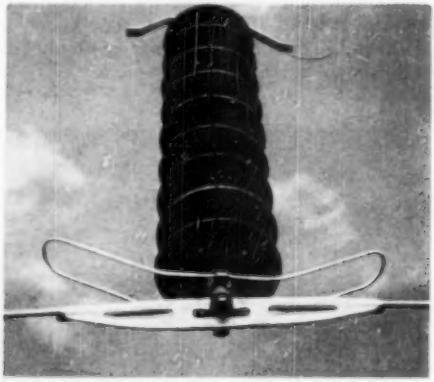


## X Rays Spot Orange Frostbite

Now they're X-raying oranges. A new machine uses the rays to spot cold-damaged fruit—the frost-bitten oranges contain less juice and therefore let more rays pass through. The machine automatically throws out the damaged oranges and separates the good ones into three grades, all at the rate of 35,000 an hour. Developed by the Automatic X Ray Corporation, the first unit is being used by Sunkist at Upland, Calif.

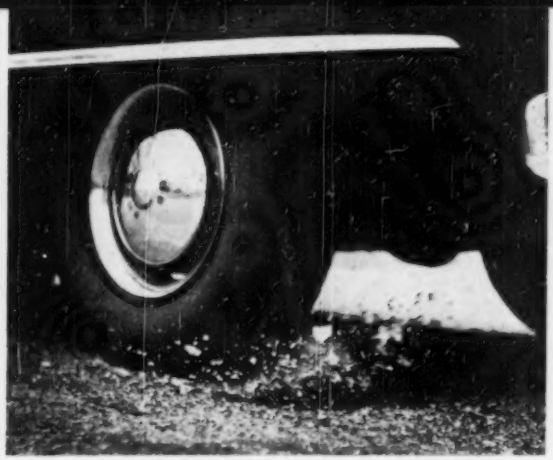
## Basket Guards Jet Intake

NORTHROP engineers aren't taking any chances on being sucked into the jet engines they work on. They designed this steel-mesh wheeled basket that can be rolled up to cover the intake port. Without the guard, it's dangerous to walk within 25 feet of the intake when the engine is revved up.



## Clamp Ends Power-Line Break

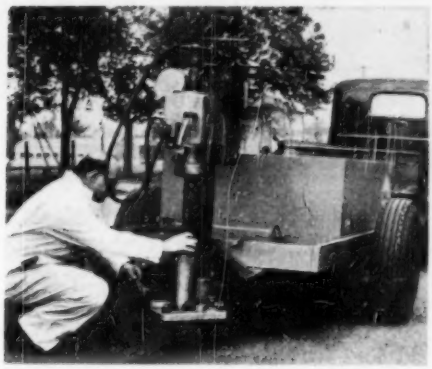
A NEW clamp to keep power lines from breaking and interrupting electric service has been developed in Europe. Wind makes the cables sway, frequently snapping them at the insulator. Ice and vibration also give trouble. Developed by Sverre Sandberg and J. Lindblom, of the Swedish Aluminum Company, the clamp has a shallow, longer bend to reduce stresses. It is in use on power lines in Norway and Sweden.



**Faulty asphalt mixture** may shed stones as above, leaving potholes, or acquire "washboard" surface by yielding under pressure.

# Diamond Tools Sample Roads

ASPHALT roads are being sampled to learn how to build better ones. Boring a hole in the surface, a whirling diamond-edged tube extracts a four-inch-diameter cross-section from top to bottom. Pieces are then squeezed in testing machines until they break. Types of paving that have lasted well or poorly in actual service thus yield their specifications in the Shell Oil Company's Wood River, Ill., research laboratory. Laboratory mixes comparing favorably in similar tests serve as guides in preparing large batches of paving material for new roads.

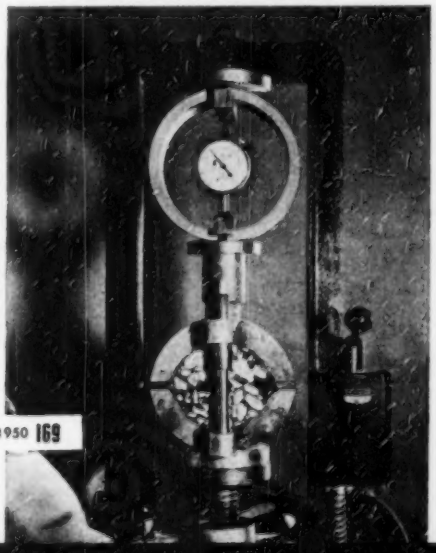


**Diamond drill** used to obtain sample of asphalt road is mounted with its ¾-hp. gasoline engine on trailer towed by car or light truck.

**Steel tube** edged with diamonds, whirling at 150 r.p.m., bites easily through rock, asphalt, and sand. Stream of water lubricates cutting tool.

**Road sample cut by drill** is lifted out. Hole left will be filled with patching material, tamped into place by drop hammer on same rig.

**Testing machine squeezes** road sample until it breaks; gauge shows force required. This predicts wearing quality of new paving mixes.



# Bird-Chasing Glider Seeks Flight Secrets

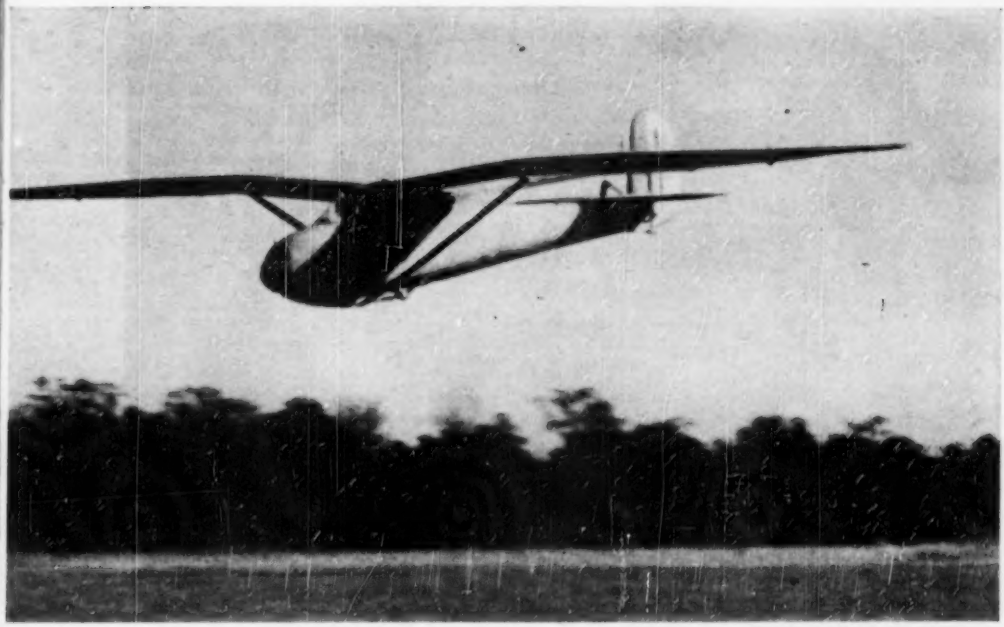
**By Ross E. Hutchins**

GLIDER pilots are now dogfighting buzzards and gulls to find out how to design airplanes that will fly as easily as the birds do. Flying a camera-carrying, English-built Kirby-Kite® sailplane, they have chased the soaring birds 15 miles at speeds up to 50 m. p. h., sometimes only 15 feet behind the bird's tail.

The glider is specially equipped for the job. Two-way radio relays instrument readings to the ground, helps the pilot spot birds to chase—and also lets him call for somebody

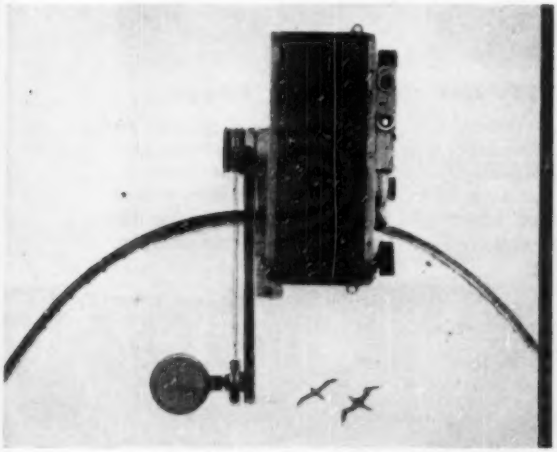
**Nose of glider** holds electrically driven movie camera that photographs bird's position once a second. This shows how soaring bird rises, falls.

**Pilot radios periodic instrument** readings to ground operator. Ground crews can spot birds more easily, so they tell pilot where to look.

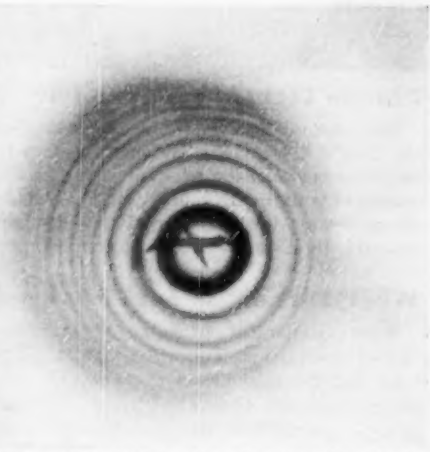


to come and get him when he must land far from his base. A time-lapse 16-mm. movie camera in the nose makes one picture every second of the bird being followed. This film tells how fast the bird sinks through the air. A 35-mm. still camera on the windshield records wing shapes.

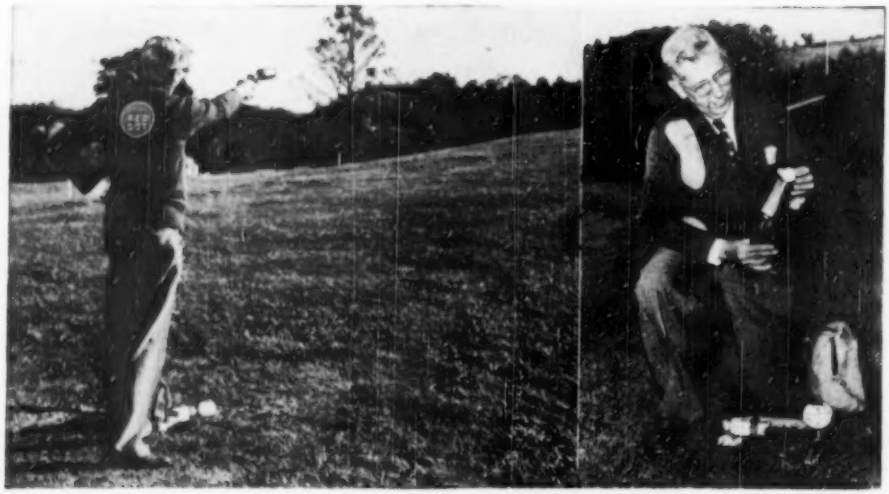
This research, directed by Dr. August Raspet, of Mississippi State College, aims to learn why soaring birds can fly so high and so long with so little effort—particularly what effect wing contour and feather porosity and arrangement have on such aerodynamic characteristics as drag. END



**A pair of gulls fly into range.** The pilot will pick them up and follow them with the help of the polarizing sight (ring at lower left).



**The gull looks like this** when seen through the sight. Skilled pilots can follow the birds closely through intricate spiraling maneuvers.

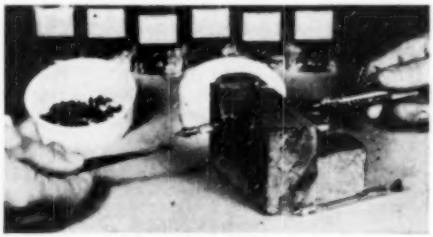


## Golfer Prefers Gun to Clubs

When Henry N. Marsh, of Wilmington, Del., shoots a game of golf, he really shoots it—with a golf-gun. A professional trap-shooter, Marsh invented the gun because he was annoyed that he couldn't drive a golf ball as far and as straight as his opponents. The gun shoots a ball 250 yards right down the middle—even if not quite according to Hoyle. It consists of a sawed-off .38-cal. pistol with a brass tube attached to the muzzle to hold the ball (right above). A blank cartridge supplies the necessary kick.

## Plastic Lights Speedometer

You can tell how fast you are driving in the dark if this plastic illuminating strip is mounted between the headlamp and speedometer of your motorcycle. A Harley-Davidson accessory, the methyl methacrylate strip channels light to the speedometer.

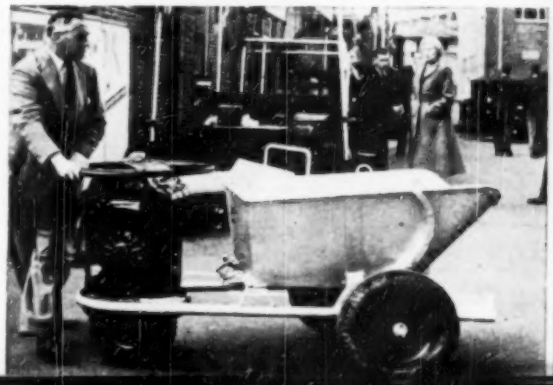


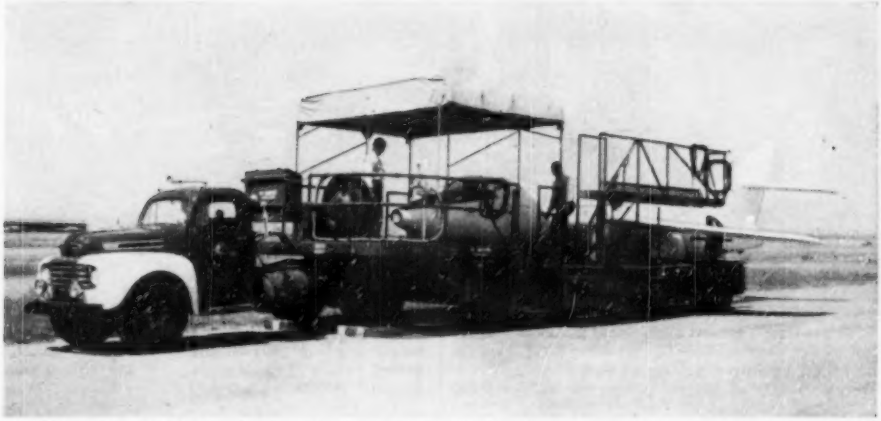
## Fly Gets Knock-Out Drops

How much insecticide does it take to knock out a fly? The Citrus Experiment Station in Riverside, Calif., is trying to find out. A fly held by tweezers, above, gets a shot of insecticide from a hypodermic needle working like a miniature medicine dropper.

## Wheelbarrow Is Self-Powered

This mechanical wheelbarrow, demonstrated recently at Tunbridge Wells, England, has the capacity of five manually operated barrows. Controlled by an operator at right, the vehicle's power unit is mounted on a turntable that turns 360 degrees. The barrow's removable carrier can be replaced with a platform for transporting machinery.

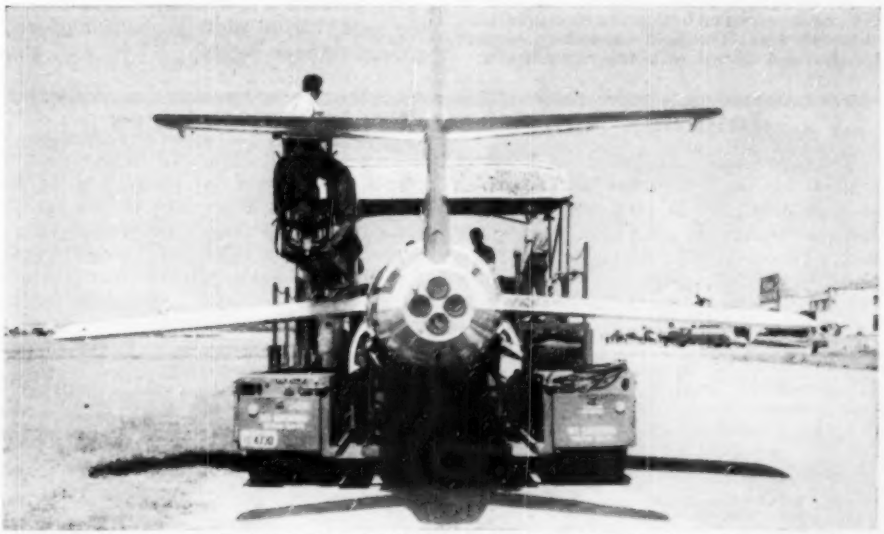




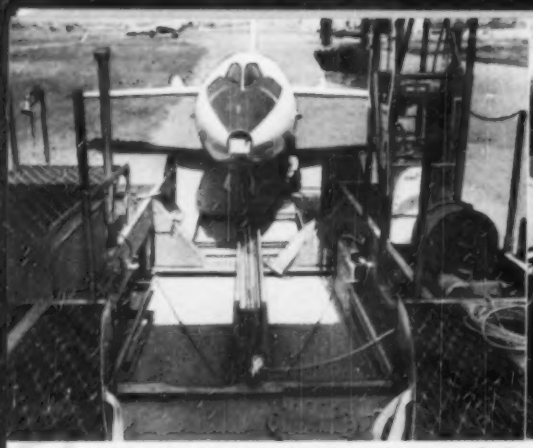
**The Skyrocket,** high-speed research plane, gets complete service as it is hauled in this special trailer along a California highway to its desert base after a visit to the factory between flights. Work platforms give crewmen access to all parts of the craft. Forward canopy shields the pilot's compartment so that it will be cool and ready for an immediate take-off on arrival.

# Mobile Service Station Mothers Sky Speedster

SOME of the world's fastest research aircraft are kiwis—birds that can't fly—under certain conditions. Because they are highly experimental in the trans- and supersonic ranges, these hot-rod planes need exceedingly wide and open areas for their Buck Rogers' flights, such as the vast expanse of California's Muroc Dry Lake



**Rear view of the novel plane-trailer built by Fruehauf to Douglas Aircraft specifications.**



**A "kneeling" action** that drops the rear end of the trailer permits the 45-foot-long Skyrocket to be rolled up into place on its own running gear. Storage batteries supply power for all services.

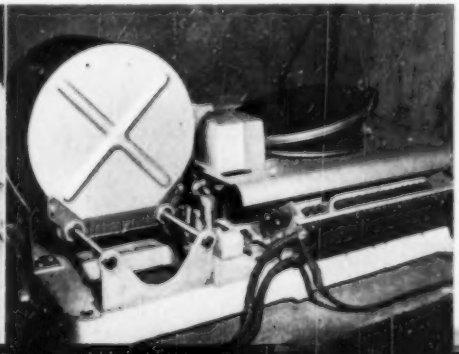
**When the aircraft is aboard,** electric motors return loading gear to place. The plane can be fueled while it is traveling. A portable pump supplies pressure to a pair of fire hoses.

**After each flight,** fuel tanks are emptied to prevent fire and then flushed out by air pressure, as shown here. The trailer includes a shower for crewmen doused with dangerous liquids.

with a natural runway seven miles long and desert wide. When a speedster of this feather—such as the Navy's Douglas Skyrocket—needs major design changes or a complete overhaul, it can't just fly back to a local airport near the factory. It has to travel the highways. So a special service-enroute trailer was built to ground-ferry the needle-nosed D-558-2 that recently flew faster than the speed of sound. A pure research plane, the Skyrocket, along with such aircraft as the Skystreak and the Air Force's Bell X-1, is exploring the effects on plane and pilot of flight at speeds greater than that of sound. The photo sequence on these pages shows how a fly baby that can crack the sonic barrier must be babied on the ground between flights. END

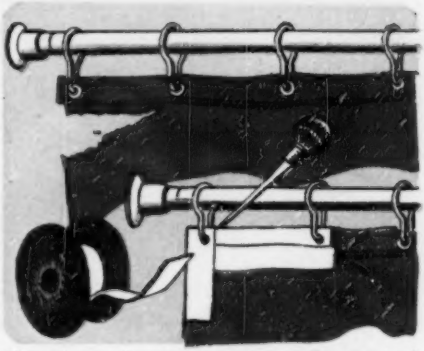
## Jukebox Announces Train Departures

THE uniformed train announcer is out of a job at the Texas & Pacific Railway station at Fort Worth, Texas. His place has been taken over by an automatic, heavy-duty record changer, right below, that plays station names and departure times over the public address system. With the two jukebox-type record selectors shown at left, a ticket seller can pick any of 38 selections to give a first and last call for each of the 19 passenger trains that arrive at and depart from the station daily. The records were made by a professional radio announcer, so that the announcements are clear and understandable. A similar system is in operation at several large airports.



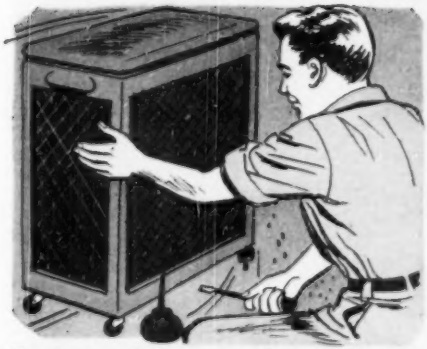
# Keeping the Home Shipshape

**By shifting the legs** from the bottom to one end, you can convert an up-ended cedar chest for duty as a cabinet in the attic or storage room. A bar for coat hangers may be added.



**Rips in a shower curtain** can be repaired with adhesive tape. Run a horizontal piece of tape along the rip. Then loop a vertical piece over it. Punch holes for the rings.

**Bind your bottle of ink eradicator** tightly to the desk ink bottle with cellulose tape. This makes spilling less likely and keeps the eradicator ready at hand for use.

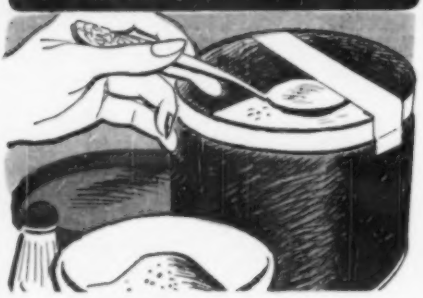


**Here's a work saver:** Attach a set of casters to the bottom of the clothes hamper. Instead of carrying the clothes, you can roll the hamper right up to the washing machine.

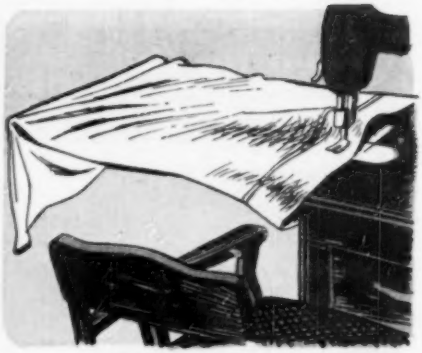
**To encourage your child** to be tidy and to take care of his clothes, screw a dime-store towel rack to the footboard of his bed. It provides a convenient clothes rack for him.

***Please turn the page for five more suggestions***

## *Keeping the Home Shipshape*

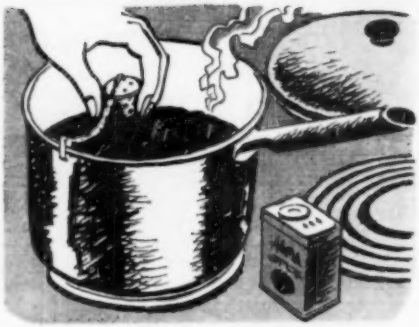


**A level spoonful** of sugar, salt, or coffee is easily obtained this way. Glue strips of cloth across the tops of the canisters. The loaded spoon is simply scraped along under the cloth.



**Slip a pillowcase** over the leaf of a sewing machine when working on silk or sheer material. It makes snagging unlikely and curbs the tendency of such material to slide off.

**White gloves and belts** will stay cleaner longer if you store them in sandwich bags. They'll be less likely to pick up dirt and wrinkles when you rummage through a drawer.



**Place spices in a metal tea ball** and hang it inside the cooking utensil. It lets the spices flavor the dish but keeps them from mixing with the food that's being cooked.

**Hairpins and cellulose tape** will hold plates on edge against the back of a cupboard. Bend the legs of the pins to 90° and turn up about ⅜" of each end. Tape holds them in place.

# Mechanics and Handicraft


*Booster Improves TV Pictures* PAGE 132

*How's Your Hot Water Supply?* PAGE 134

*Easily Built Home Accessories* PAGE 137

*Spot Welding on a Drill Press* PAGE 139

*Processing Your Own Photos* PAGE 140

*What Makes This Engine Run?* SEE PAGE 136 JANUARY 1950

# Gus and the Flying Keys

**By Martin Bunn**

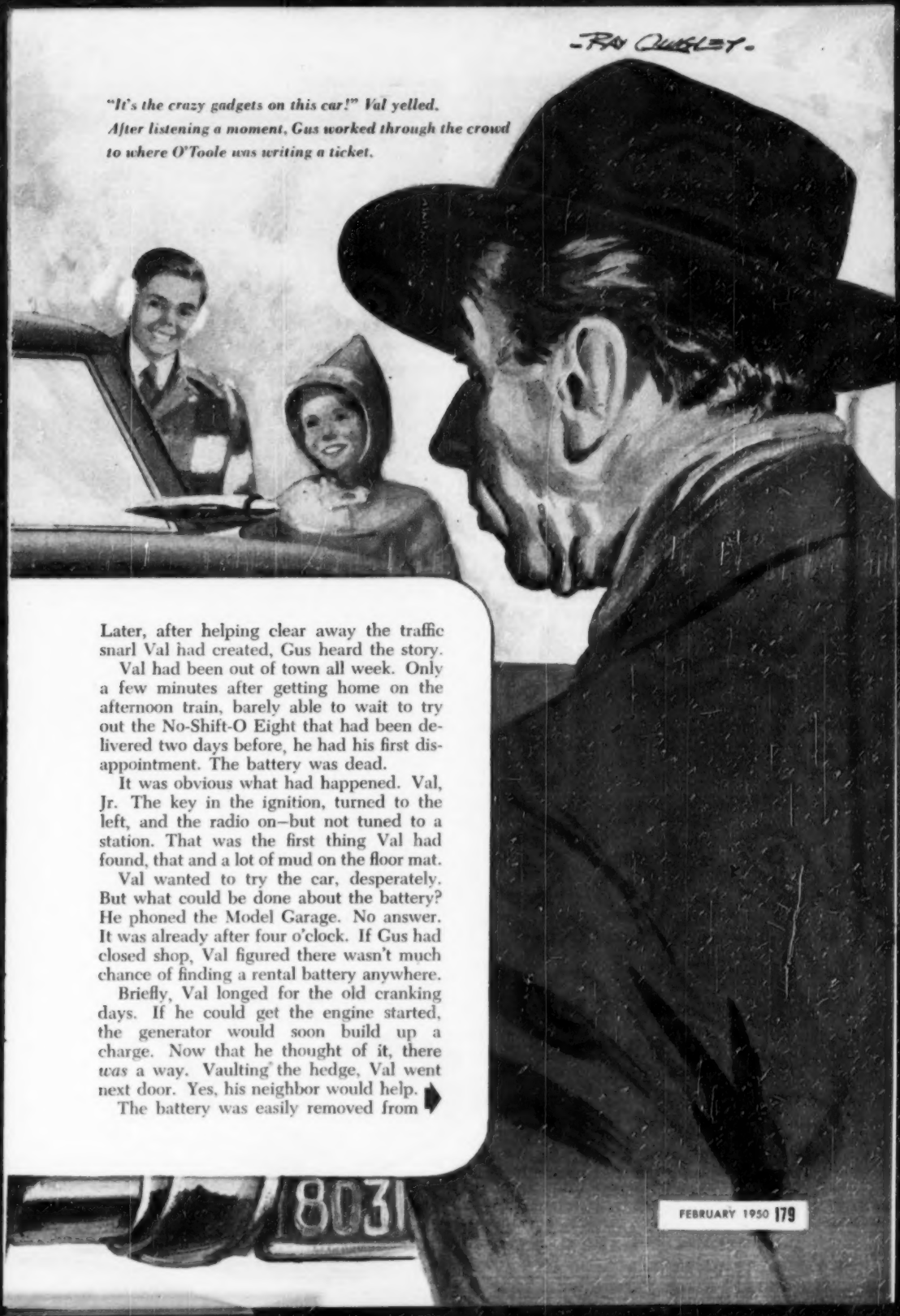
DURING his years in the Model Garage, Gus Wilson has seen a lot of disgruntled motorists. But not one of them was more fed up with a car than Val Murdock the day Officer Cecil O'Toole handed him a ticket for reckless driving at Main and Center Streets.

It was strange, too, about Val. Usually, he is a very careful driver. And it would seem he had every reason to be pleased with the car. It was brand new, a superduper convertible equipped with automatic transmission and all the other modern improvements—a job to take anyone's fancy.

Gus got into the case just by chance. It was late Saturday afternoon. As he stepped from the Men's Shop after buying a couple of shirts, a small object hit the pavement with a metallic clatter. It had come from the midst of a crowd gathered around Val's car—stopped dead in the middle of the intersection.

Gus looked down. A set of car keys. Stooping to pick them up, Gus heard Val's angry voice: "I'll never drive it again! I'm through!"

The situation *must* be bad, Gus decided, if it could cause Val to throw away his keys.




*"It's the crazy gadgets on this car!" Val yelled. After listening a moment, Gus worked through the crowd to where O'Toole was writing a ticket.*

Later, after helping clear away the traffic snarl Val had created, Gus heard the story.

Val had been out of town all week. Only a few minutes after getting home on the afternoon train, barely able to wait to try out the No-Shift-O Eight that had been delivered two days before, he had his first disappointment. The battery was dead.

It was obvious what had happened. Val, Jr. The key in the ignition, turned to the left, and the radio on—but not tuned to a station. That was the first thing Val had found, that and a lot of mud on the floor mat.

Val wanted to try the car, desperately. But what could be done about the battery? He phoned the Model Garage. No answer. It was already after four o'clock. If Gus had closed shop, Val figured there wasn't much chance of finding a rental battery anywhere.

Briefly, Val longed for the old cranking days. If he could get the engine started, the generator would soon build up a charge. Now that he thought of it, there *was* a way. Vaulting the hedge, Val went next door. Yes, his neighbor would help.

The battery was easily removed from

the neighbor's car. Luckily, he was one of those rare individuals who keep the corrosion cleaned away and the terminals coated with petroleum jelly.

Carrying the battery to Val's garage, they hooked it up in parallel with the dead one, pressing into service two lengths of welding cable and four C clamps to make the connections. The engine was soon running smoothly.

Val had returned the borrowed battery and was just straightening down the cleaned floor mat when his wife Marge opened the back door. "Oh, Val," she called, "would you go over and pick up the laundry?"

Traffic was light on the side street, and after driving a couple of blocks Val began to relax and enjoy what the salesman had extolled lyrically as clutch freedom. Automotive engineers really had a lot on the ball, he decided. Gears that shift themselves, and no clutch pedal to bother with!

He overtook an ancient sedan. The street ahead was clear. He sheered out from behind the slow-moving car, and pressed the accelerator all the way to the floor board. The transmission downshifted sweetly, and exultation flooded Val's middle-aged soul at the smooth surge of power that swept him swiftly past the old car. Some bus, this baby!

### *But the Car Keeps Going*

A block ahead a green light blinked to yellow and then to red. Val didn't slow down—maybe it would turn green again before he got to it. It didn't. He took his right foot off the accelerator and braked lightly, while his left foot pawed instinctively for the clutch pedal—which wasn't there. "Dumbell!" he reproached himself, and braked harder.

But the car kept right on going! As the stop line flashed under the front wheels Val really stomped down on the brake. The car slowed, but it was around the corner into Main Street before he could stop it.

He had shifted the selector lever to "Neutral," but the engine was racing. Puzzled, he fiddled with the accelerator. After a few seconds the engine slowed to idling speed. Funny about that, he thought. Must have done something wrong. Better be careful.

Pulling into the parking lot adjoining the laundry, Val eased the car to a halt and, through habit, reached over and turned off the ignition. Back with the package of laundry, he suddenly remembered he had intended to leave the engine running. "Oh, well," he thought resignedly, "there should be enough juice now to start it once."

### *Will the Engine Start Again?*

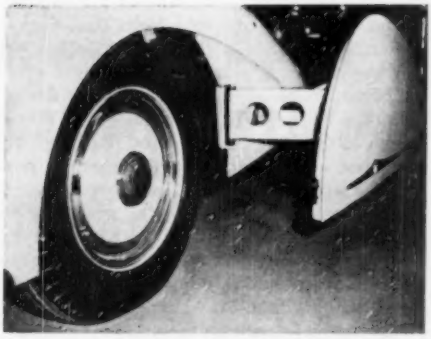
In the parking space next to his a horse-faced man in a battered sedan was regarding the new car and its owner with an expression that Val classified as sardonic.

A little disconcerted by this inspection, Val forgot he wasn't in the old coupe. He reached his left hand out to where the starter button should have been—but it wasn't there. "Watch what you're doing, you dope!" he chided himself. He located the button and pressed it—but nothing happened. There wasn't a peep from the starter.

Puzzled, Val checked over the controls. There, that was it! He had forgotten to shift the control lever to "Neutral." A neat little safety feature that! No juice could flow through the starter circuit until the car was in neutral.

The engine finally caught, but Val was so badly flustered that he shifted the selector lever from "Neutral" to "Reverse" instead of to "Drive," with the disconcerting consequence that when he released the hand brake and pressed the throttle pedal, the car shot backward. Only his frantic application of the brakes stopped it in time to avert, by inches, a crash with a delivery wagon parked twenty feet behind.

Val mopped the cold sweat off his brow



**Fender Skirt Swings Outward**

WHEELS are fully enclosed on the latest Rolls-Royce Wraith model, but tire changing is made easy. The entire skirt swings out on a hinge, giving ready access to the wheel. Two catches keep the skirt locked in place during normal operation.

**Washer Sprays Entire Car**

STANDING in one position, an operator can swing this counterbalanced arm back and forth to wash a car from end to end. Fully self-contained, the spray-jet washer even has its own soap supply. It's made by Phillips Pump and Tank Co., Cincinnati, Ohio.

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and tried again. This time he manipulated the selector lever according to Hoyle, and went in the direction he expected to go.

The traffic thickened and slowed as he neared the intersection of Main and Center. Out on his little safety island Officer O'Toole, tired, nervous, and short of temper after four straight hours of duty, was controlling the lights manually, and making the most of every chance to keep the cars moving.

When the last automatic light before Center Street turned green, the block between it and the intersection was clear of traffic. Val's car was the first in line, and he took advantage of the break by speeding up to the 25-mile limit. But just before he reached the intersection O'Toole switched the Main Street light to red. In an instant Center Street cars were half-way across the intersection or making right turns into Main, and impatient pedestrians were flooding the street.

### *Why Val Threw Away the Keys*

Val's right foot moved swiftly and surely from the accelerator to the brake pedal. But again his car kept on going! It missed the rear end of a truck by a scant inch, and a fear-paralyzed shopper by half as much. Women screamed. Men cursed. Horns squawked. Val put everything he had onto the brake pedal, and the car came to a grinding stop a yard short of the safety island. Val jumped out.

Officer O'Toole blew a whistle blast that set brakes to whining two blocks away, and switched the Center Street light to red. Then, his face fiery, his jaw out, and his eyes blazing, he stalked over to Val. "What in blazes is th' matter with you?" he roared.

Val Murdock is a peppery sort of citizen. His temper slipped its leash, and he blew his top. "There's nothing the matter with me!" he yelled. "It's the crazy gadgets on this car!"

It was then that Val reached into the No-Shift-O, snatched the ignition keys, and hurled them as far as he could.

By the time Gus got out into the street, the mutual fury of O'Toole and Val had set most of the onlookers to laughing. Gus didn't join in—he has seen too often the tragedy an out-of-control car can cause. After listening a moment, he worked his way through the crowd to where O'Toole was writing out a ticket while Val glared. "Hello, Cecil," he greeted. "Hello, Val—here're your car keys—you might want 'em. Anything I can do?"

O'Toole looked up from his writing. "Mebbe you can get this bus out of the middle of the intersection," he growled. "I wouldn't trust this nut to do it."

Gus and Val got into the car. Gus pressed the starter button, but nothing happened. "Oh, Lord," exclaimed Murdock. "I forgot to tell you. The battery's dead. If it was only the old car, we could get a shove. I don't know if you can push these things."

"You sure can," Gus said, "if you know how. Cecil, ask that lead car over there to give us a fast shove up the street, will you?"

As the other car nudged its bumper against the rear one on Val's car, Gus moved the selector lever to "Neutral." Slowly, the cars picked up speed. When the speedometer registered 20 miles per hour, Gus switched on the ignition and moved the selector lever to "Drive." The engine quickly caught.

"Easy, isn't it?" Gus asked. "You won't do any damage if you do it just as I did. But you should always remember to move the lever to 'Drive,' never 'Low.' And don't push any of these cars faster than 25 miles an hour or more than two miles."

For several blocks the No-Shift-O performed beautifully. Then, when Gus took his foot off the accelerator, the car didn't slacken speed. Quickly he moved the lever to "Neutral" and applied the brake. As the car stopped by the curb, he set the hand brake. "Accelerator's jammed," he said. "Let's take a look. If I can't find the trouble right away, I'll get the wrecker and tow your car in. It's only a few blocks, but I'm not driving a car with a stuck accelerator even that far."

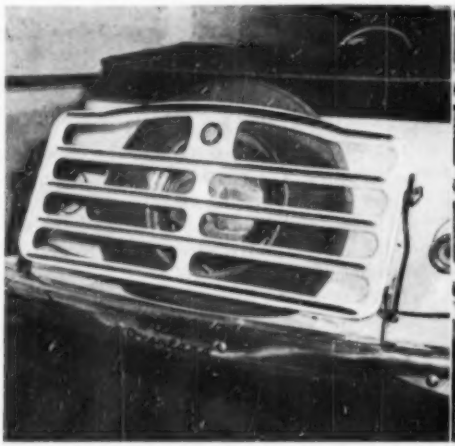
A few minutes later Gus straightened up. "The trouble is," he told Val, "that the accelerator rod, under the treadle, is jammed by the rubber floor mat. Sometimes it works all right, and sometimes it doesn't—and when it doesn't it holds the throttle open. There's really nothing to fix—someone has taken the mat out and replaced it in the wrong position. I'll put it back so the rod works freely."

Val looked guilty. "I'm the guy who did it," he confessed. "My kid had tracked dirt all over the mat. So I took it out and washed it—you know how a fellow is with a brand-new bus. But say, Gus—I'm not sure I'll ever trust that automatic shift again."

"Of course you will," Gus reassured him. "As soon as you get to understand it. It's an improvement—a big one. In a couple of days you'll wonder how you ever got along without it. And I don't think there's much chance you'll ever be bothered again with a sticking accelerator. But if you should, just remember to move to 'Neutral' in a hurry.

"There's another thing, too. A car with an automatic-shift device has to be driven, just as much as a Model T had to be driven. No one ever has built a human brain into an automobile—and you can take it from me no one ever is going to!" END

## Folding Rack from Old Car Boosts Luggage Space



SHORT of luggage space, B. C. Bowker, of Toledo, bought an old-style, outside rack at a junk yard and put it on his Willys Jeepster as shown. For use, it swings down flat.

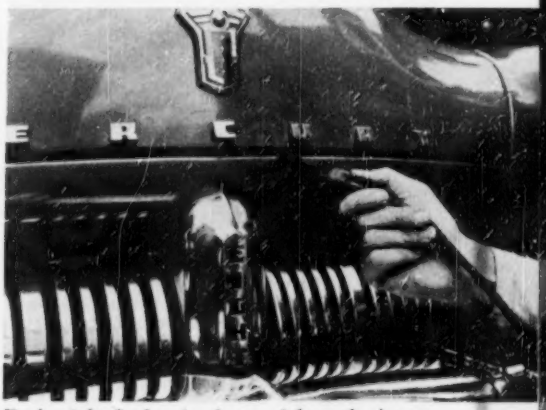
The rack was mounted by removing the bumper and cutting small holes through the body metal to accommodate brackets made of ¼" steel strap. Each bracket consists of a vertical member welded to the upper of two clamping pieces located horizontally across the bumper braces.

Before installation, the rack was painted to match the car and its chrome trim reconditioned. Such racks once were widely used.

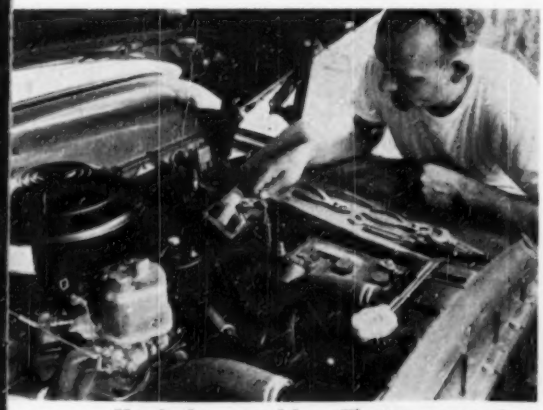
# Here's How I Start My Car in the Morning

By Victor Dettling

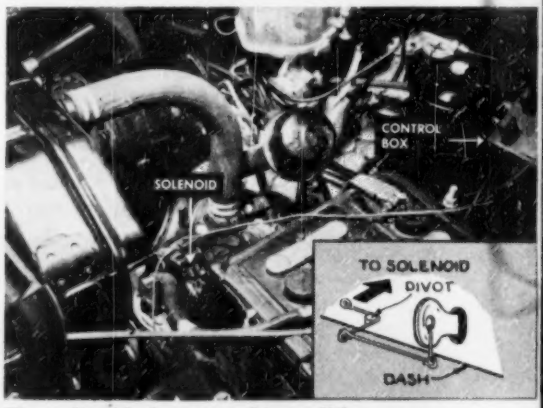
**Before breakfast I press a switch** near the window in the dining room. This closes a circuit leading to my car out in the garage. The object is to start the engine and have it at operating temperature before I set out for my job at an automobile plant in Manchester, Mich. The line leading from house to garage is a heavily insulated, two-conductor electric cord.



**Each night I plug in the cord** from the house after putting the car in the garage. The plug and socket are the type you would use in ordinary electrical wiring around the house. The socket is permanently mounted above the grille as shown. One terminal is grounded to the car body. The other is connected to a control box developed especially for my starting system.



**Here's the control box.** The two pegs projecting from the end are part of my safety system. Free to move lengthwise through the box, these rest against the gear-shift control rods. The engine can start only if car is in neutral. If a gear is engaged, the bars move, breaking an electrical contact. The box has another job, too, but I'll explain that later. From the box, a wire runs to a powerful solenoid starting switch installed in place of the original one.

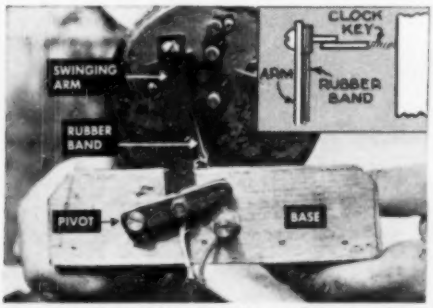



**The solenoid does two things.** When energized, it completes the starting-motor circuit. At the same time, by magnetic action, it exerts a pull on a wire linked to the ignition key by a bell crank as shown in the drawing. This turns the key. After the engine starts, increasing manifold vacuum acts on a diaphragm in the control box, breaking the starting circuit.

***But, that's not all: Turn the page and see***

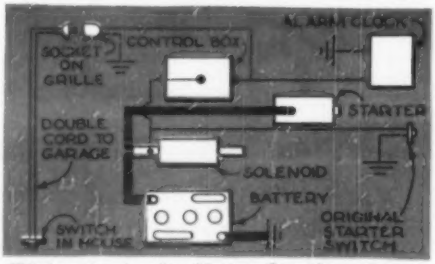
# *Just Before Quitting Time An Alarm Clock Starts Up Engine*

**During the day** I leave the car in an outdoor lot near the plant. After parking, I set my alarm-clock switch, timing it a few minutes before quitting time. When the alarm rings, the engine starts automatically. This gives it a chance to warm up before I start home. I keep the clock switch in the glove compartment.

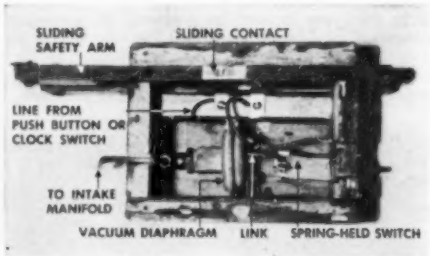



**The switch works like this.** After the alarm has been wound, a bolt through the swinging arm is hooked over the winding key, as shown in the drawing. When the alarm goes off, the key releases the arm, permitting the rubber band to pull it down and close the circuit. This does the same job as dining-room switch.

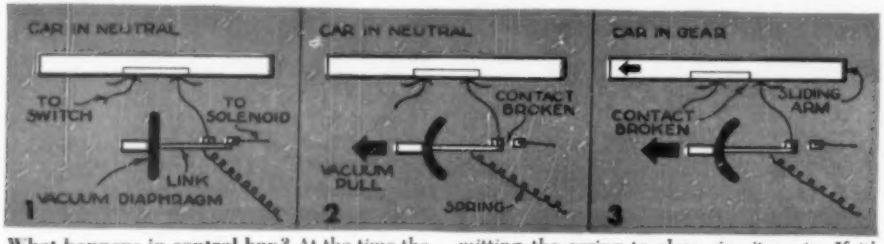
## *Here Are the Details of the System*




**Wiring is simple.** Notice that the automatic system operates independently of the original starter switch. The wire and parts required to set up my system cost me about $23.

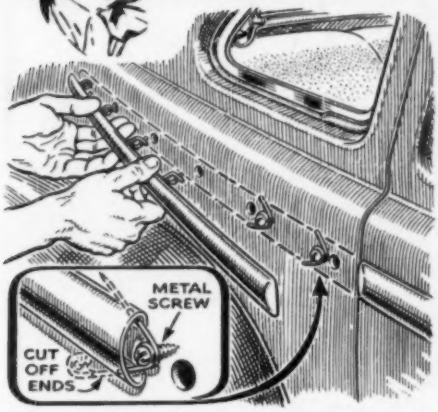



**A vacuum diaphragm** is an important part of the control box. When the engine starts, rapidly increasing manifold vacuum moves the diaphragm and link, breaking the starting circuit.

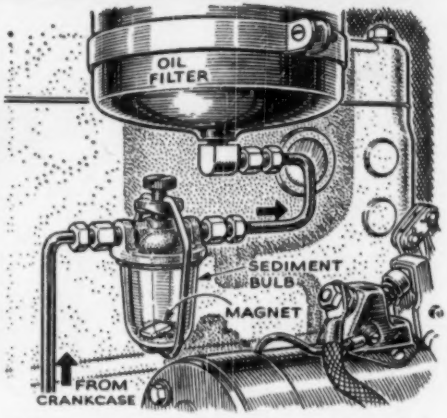



**What happens in control box?** At the time the alarm clock goes off, or I press the dining-room switch, you have the situation in Fig. 1. Since there's no vacuum, the spring can keep the vacuum switch closed. When engine starts, vacuum overpowers the spring, breaking the circuit as in Fig. 2. This disengages starter. If the engine stalls, the vacuum disappears, permitting the spring to close circuit again. If it's the clock switch that has set off the system, current flows again—and again—until the engine catches or the battery runs down. While I'm driving the car, the vacuum and—when it's in gear—the sliding arm cut out the automatic system (Fig. 3). Moreover, the leads from the clock or the house are disconnected then. END

# Hints from the Model Garage

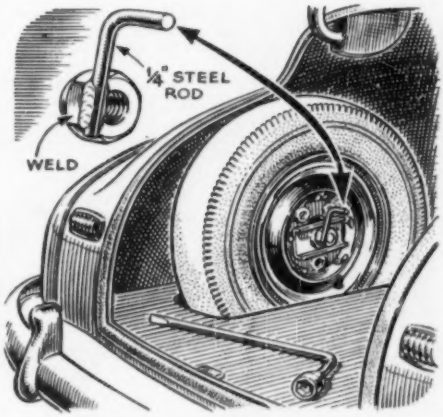



**Safety Pins Hold Chrome.** If a trim strip on your car has lost any spring clips, safety pins will fasten it down. Cut the ends off each pin as indicated and attach to the body metal with a self-tapping screw through the loop of the pin and into a small drilled hole. Snap the trim strip over the cut ends of the pin.




**Magnet Helps Filter Oil.** B. M. Thomann, of Kenmore, N. Y., finds that this setup gives his oil filter a helping hand and prolongs the life of each cartridge. It consists of a fuel filter with the element removed and a permanent magnet resting in the bowl. Considerable sediment settles out and the magnet holds fine metal particles.

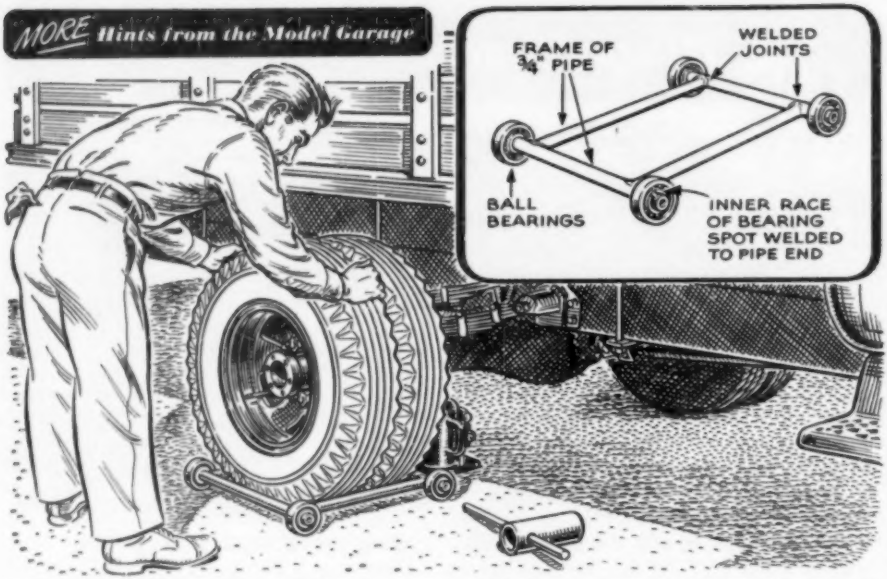
**Straightening Hub Cap.** A bucket or tub of sand and a rubber mallet are all you need to bump most dents out of a hub cap. Work from the inside of the cap, using light taps and checking frequently to keep from making new outward dents.




**Welded Crank Loosens Spare.** In some cars, it's difficult to swing the lug wrench to loosen or tighten the nut that holds the spare. J. W. Rocke, of Globe, Ariz., suggests making the job easier by welding a crank to the nut as shown.

*Turn the page, please, for three more auto hints*

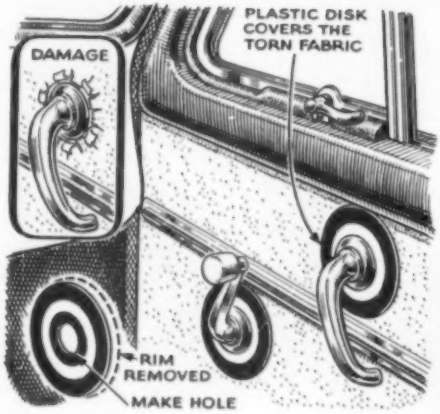
## MORE Hints from the Model Garage




**Dolly Handles Dual Tires.** For removing and installing dual truck tires as a unit, Charles D. LaRue suggests making up a dolly like this. The original is in use at a shop in Sacramento, Calif.

The dolly is inexpensive to make. Four used ball bearings will serve as the wheels. Adjust the frame dimensions to suit the size of the truck wheels.

To use, lower the jacked-up wheels on the dolly. After removing the retaining nut, you can then pull the wheels away on the dolly.

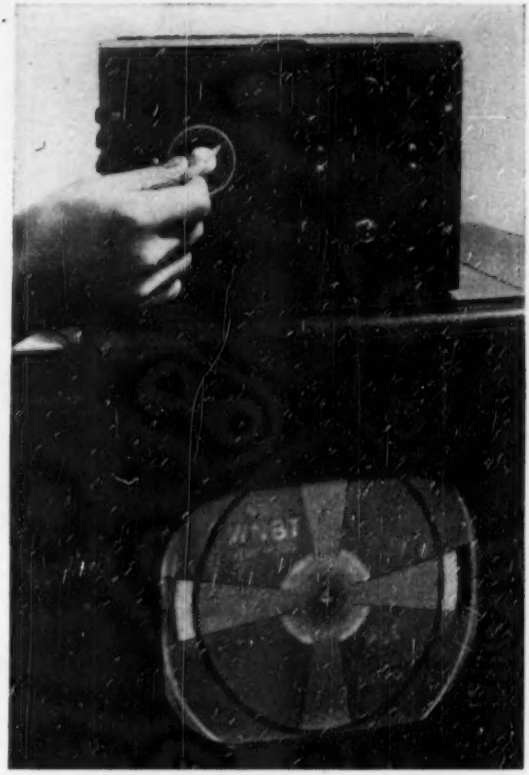



**Repairing Handle Wear.** Plastic coasters from the dime store can be used to hide torn fabric around a door handle. Cut the rim from the coaster and make a hole large enough to slip over the handle. Clamp in place with the original flange.

**Handy Polishing Pads.** Pieces of old carpet run through the washing machine and then dried make convenient pads for polishing cars. If no old carpet is available, your furniture store may be able to supply small remnants.

**The $8 unit** at the right "melts" the snow that flakes through weak signals, sharpens and brightens images.

# Homemade Booster Improves TV Pictures



**Amplifying distant signals may give you grandstand reception in the bleachers.**

ARE your TV pictures as good as they ought to be? If not, you may be able to help yourself to greater video enjoyment with a booster that will strengthen weak signals on the low channels.

"Snow" in a picture is a sure sign of weakness. Not only can a booster cure this condition but it can also sharpen image outlines and improve contrast and clarity.

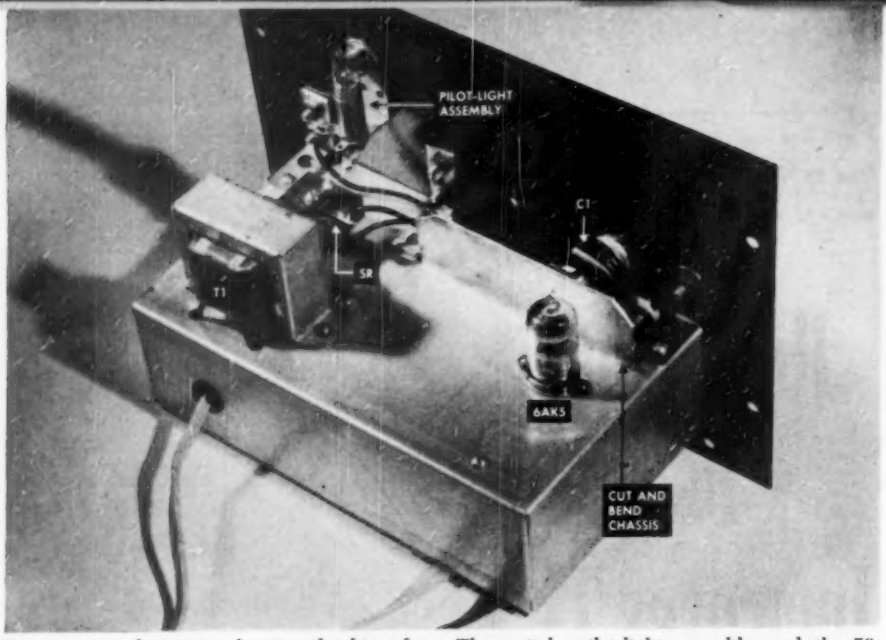
The unit shown above can be built for about $8. You can use it with either an indoor or outdoor antenna, but it won't take the place of either. It improves a signal, but doesn't create any where none exists. If you live in a fringe area you will still need your roof-top rig. But whatever your antenna, if you are now getting pictures that are under par, a booster will help.

Though the range of this booster covers only the first five channels, it is so designed as to cause no interference with high-band stations. You can leave it connected even when you're looking at channels 7 to 13.

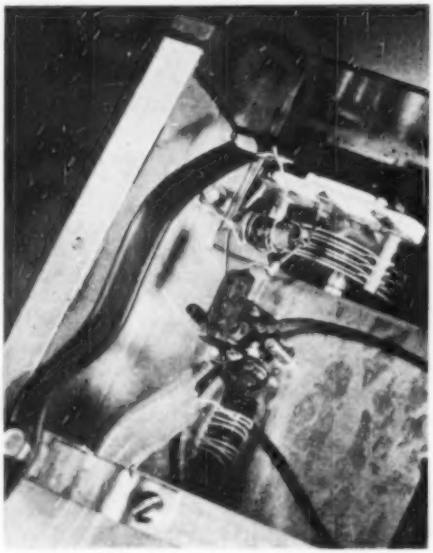
Two lengths of 300-ohm flat-ribbon lead-in are wired directly to the coils. One of these (marked "IN" in the diagram on page 189) goes directly to the 300-ohm lead from the antenna. The other goes to the antenna terminals on the receiver. Placed ahead of the receiver input, the booster acts to amplify signals coming in from the antenna. The unit has its own power supply and must be plugged into an AC outlet.

To put the booster in operation, first tune in the station on the set, then tune the booster by varying the tuning condenser. This is the amplifier's only control. For channel 2, set the pointer knob so that the plates are fully in mesh. Find the best setting for each channel and mark the dial accordingly. For high channels set the pointer so that the plates are out of mesh.

Want one? Turn the page for building instructions.




**You can use** almost any chassis and cabinet for this unit. The transformer, selenium rectifier, and the single tube are on top of the chassis, which is bolted to the front panel with angles. The switch, pilot-light assembly, and the 50-mmf. variable condenser are on the panel. The tube is directly behind the condenser, but note the 1" ledge bent up on the chassis as a screen.

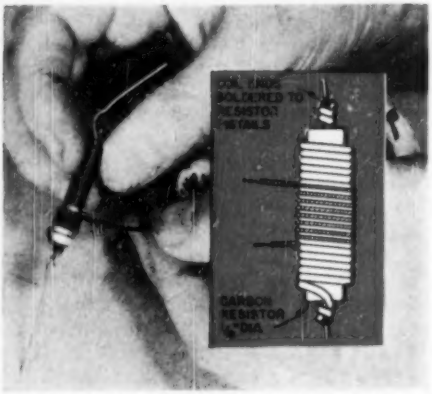


**To keep RF losses** to a minimum—which is important at television frequencies—make wiring compact This close-up shows a 7-pin miniature ceramic tube socket with all related parts clustered in a tight huddle around it. Leads are soldered directly to socket-pin lugs. All ground connections are gathered at one point on the chassis near the tube socket.

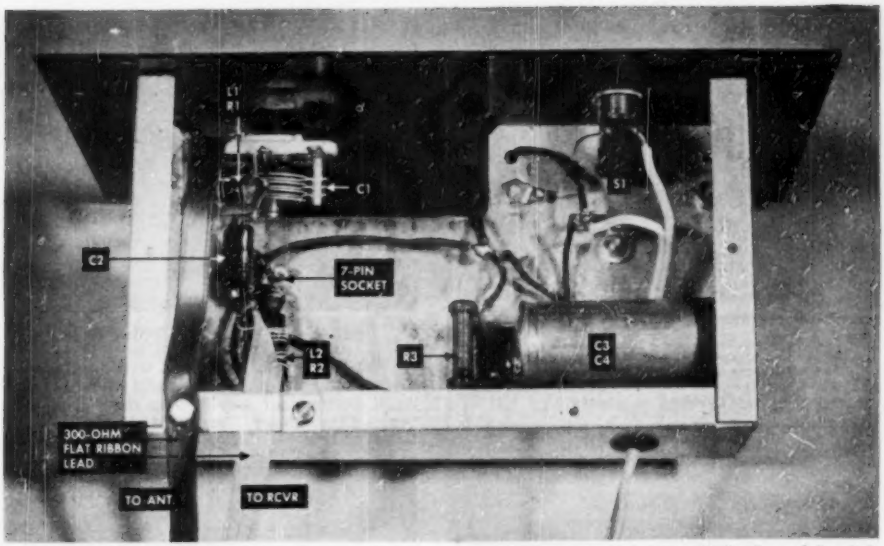
**COIL-WINDING DATA**

*(Wind L1 on R1 and L2 on R2)*

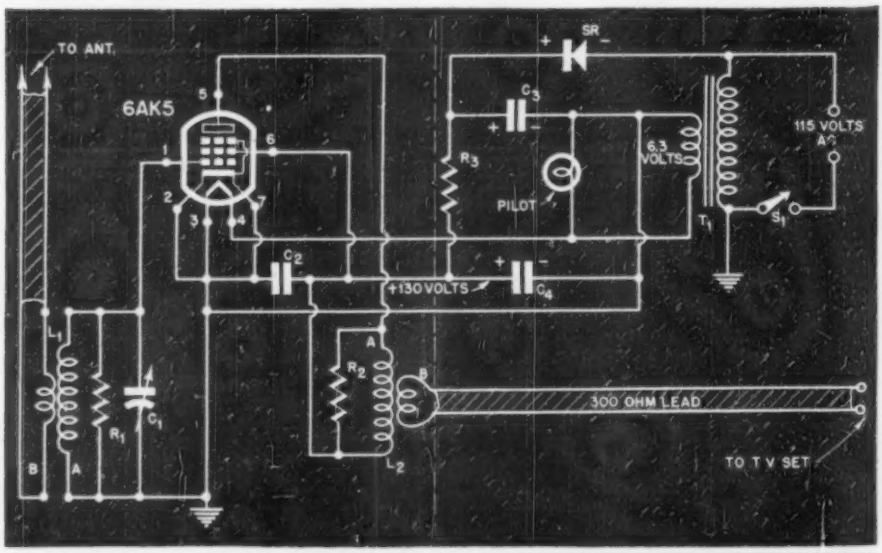
L1A: 6 turns No. 18 enamel (close wound)
L1B: 8 turns No. 30 D.C.C. (wound over L1A)
L2A: 19 turns No. 18 enamel (close wound)
L2B: 8 turns No. 30 D.C.C. (wound over L2A)




**Another dodge** for compacting parts is to use resistors R1 and R2 as forms for winding coils L1 and L2. To do this, you should purchase 1-watt resistors with diameters of ¼". The table specifies the number of turns for each winding, but don't take that for gospel. Your booster may show better results with fewer or more turns. Experiment with both 8-turn windings.




**The dotted line** dividing the diagram below and the space in the middle of the photo above separate the booster circuit into its two parts. Wiring to the right of the line requires no special precautions. But all leads to the left with the exception of the 300-ohm ribbon lead must be kept as short as possible. A close-up of this portion is shown on the facing page.




## LIST OF PARTS

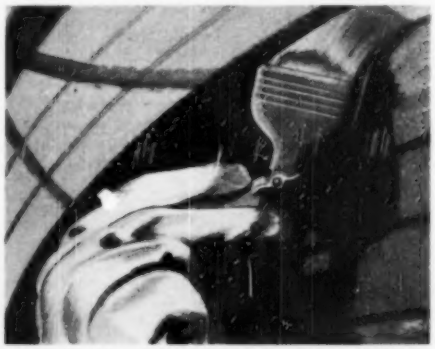
R1: 5,000-ohm, 1-watt carbon, approx. ¼" dia. (Use as form for L1)
R2: 2,000-ohm, 1-watt carbon, approx. ¼" dia. (Use as form for L2)
R3: 1,000-ohm, 1-watt carbon.
C1: 5- to 50-mmf. variable condenser.
C2: 150-mmf. mica.
C3: 40-mfd., 150-volt electrolytic.
C4: 20-mfd., 150-volt elect. (May be dual unit with C3).
S1: SPST toggle.
SR: 75-ma. dry-disk selenium rect.
Pilot-light assembly with 6.3-volt brown-bead bulb, chassis, cabinet, 7-pin miniature ceramic socket, 6AK5 pentode, 300-ohm flat-ribbon lead, set of coils (see text and table), misc. hardware.

# I'd like to see them make . . .

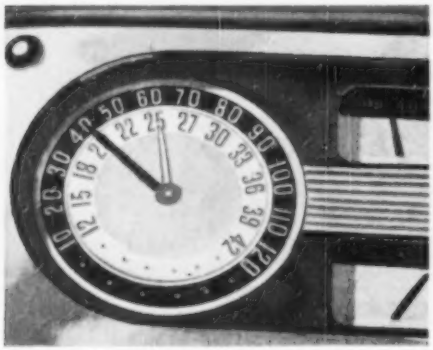
**Everybody has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.**

**Oil cans with weighted bottoms.** Oil cans should be built with almost round, weighted bottoms. Then if knocked over accidentally they would automatically right themselves. A small bottom flat would keep them from bobbing.—*Don Salmon, Detroit, Mich.*

**Retractable sun visors.** The solid-type visors make it very tough to see an overhead traffic light when you're driving in the city. They could be made so you could crank them in and out of the car top.—*D. H. Boyd, Cincinnati, Ohio.*

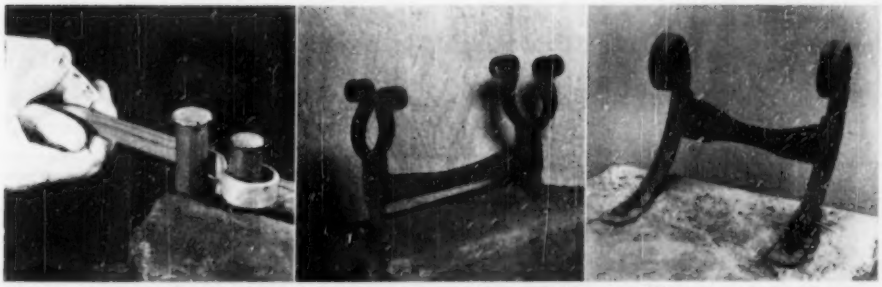


**Paint brushes with jointed handles.** The handle could be locked at various angles with a thumb nut. It would be handy for painting in cubbyholes such as you find aboard a ship. —*M. J. Steppello, S1c, U.S.N.*




**Combined speedometer and tachometer.** This instrument could be built with two hands, like a clock. The inner dial would show the engine r.p.m., the outer one would show the speed of the car.—*Bernard E. Morris, Belhaven, N. C.*

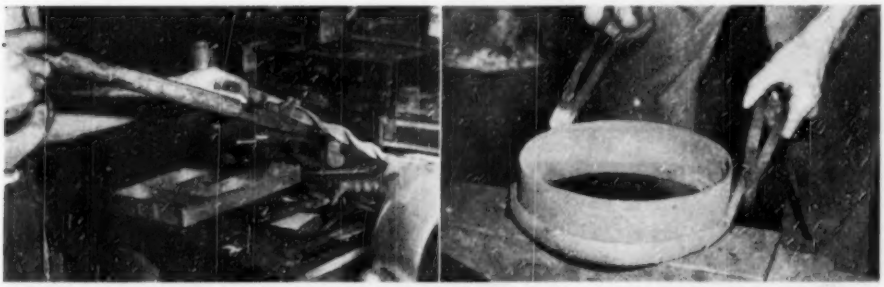
**Mixing directions** on the lid of paint cans. Instead of putting directions on the sides, where they get smeared with paint, why not put them on the lid? They'd stay clean and be easy to read.—*W. A. Rice, Hartford, Conn.*



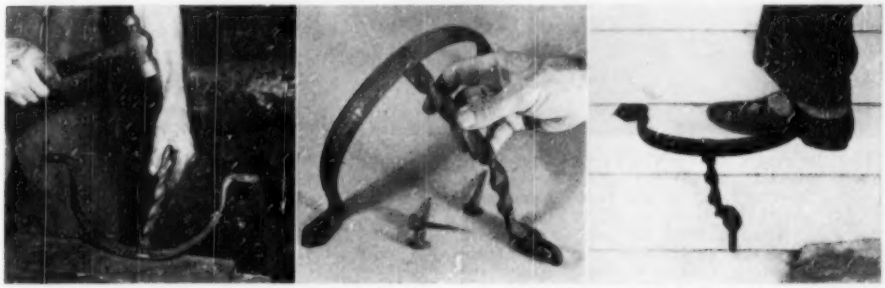
**Shanks of two cold chisels** are locked in a vise to form a jig for bending scrolls. The split posts (center) were twisted into a tulip design. At right is another scroll-design scraper. This one was fixed in a block of marble with hot lead. Marble was set in ground near front steps.

# Foot Scrapers You Can Make

THE foot scraper is one of the few home accessories that haven't shown much improvement in design down through the years. With that in mind, John P. Arnold, of Doylestown, Pa., went back to the products of Colonial metalworkers for the scrapers pictured here. All of those shown predate 1800. The best reproductions, of course, are made by working hot iron on an anvil. However, some types can be bent from cold metal and the parts riveted. END



**Supporting bracket** for a wall-mounted scraper is twisted to shape with vise and wrench. Length of pipe over wrench handle adds leverage, but don't treat a good wrench this way. Above, heated scraper blade is formed by bending it around an iron hoop of suitable diameter.

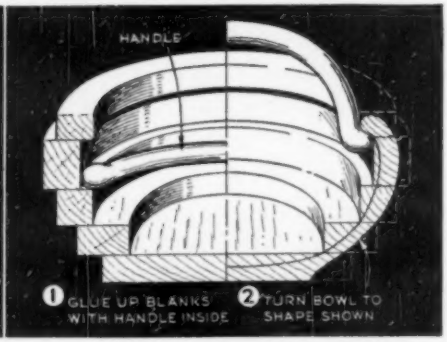


**Scraper blade and bracket** are assembled with a single rivet. Center photo shows completed unit and the three wrought nails that hold it to side of the house, mounted as pictured at the right. This kind of Colonial scraper is much less common than those at top of page.

# Wood-Turning Tricks

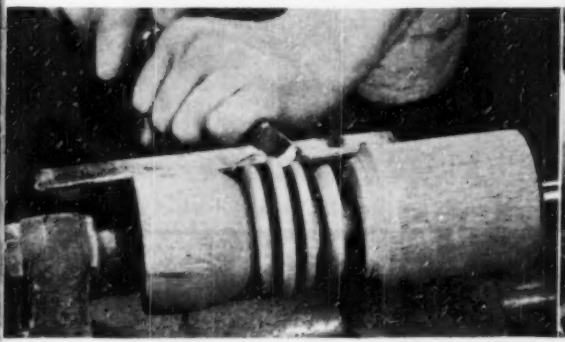
**1 Too small to slip over** the base or bowl, the rings at the left have no practical use—but they'll mystify your friends. They were produced by simple turning. To begin, hollow out the bowl with a narrow skew as seen above. Finish with a round-nose scraper. Leave a stub to hold the dead center, turning it small toward the end of the work. In turning the goblet, you could mount the block on a faceplate, but the setup pictured above is more rigid.

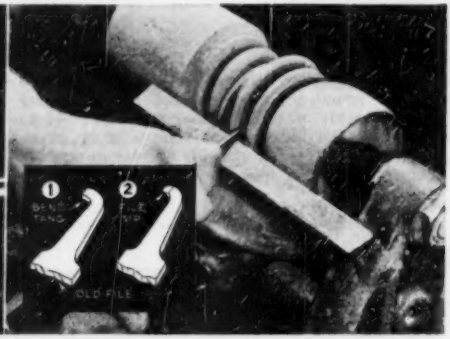
**Here the ring's inside.** The captive ring above has a practical use. Pulled up, it serves as a handle for the bowl. If the bowl is undercut deeply, you have plenty of waste material for the ring. After turning the outside of bowl, hollow the inside to sufficient depth to permit turning the near face of the ring. Shape the back face of the ring and cut it loose with ring tool you have made from a file.




**Glue does the trick here.** In this case, the handle is made before the bowl is turned. The trick is to glue up the bowl blanks with the handle trapped inside. If you wish, you can make the handle of some contrasting wood—or of metal or plastic.

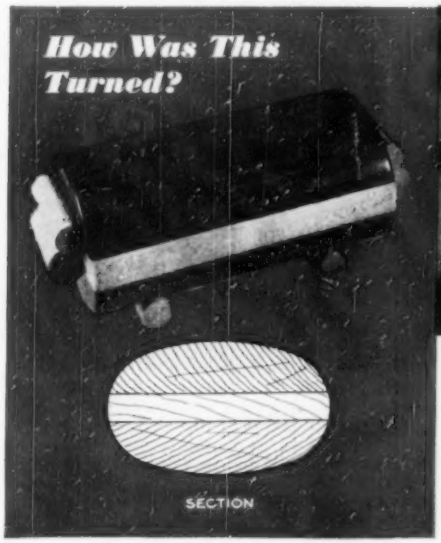
***In previous issues, Edwin M. Love has told Popular Science readers how to turn spindles, disks, and bowls. Here are some lathe tricks that knowledge of those techniques makes possible***

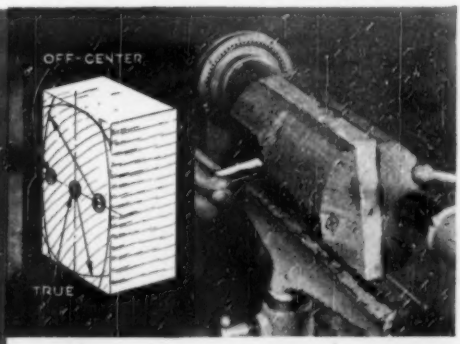




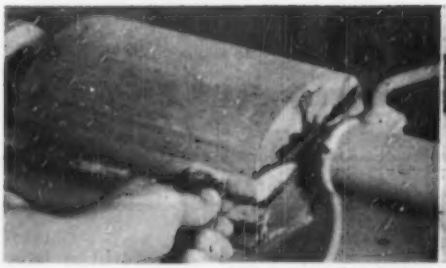

**2 Locate the rings** with cuts of parting tool and round them on the outside as above. Space the rings as far apart as possible to provide working room. Rough-turn the bowl and base before starting work on the rings.

**3 Round the rings** on the inside and separate them from the stem with a special tool made from an old file. After bending tang, grind a tiny round-nose chisel on its tip. Sand the outside of the rings before cutting them loose. Sand the inside by hand. After the rings are loose, hold them to one side while giving finishing touches to the stem, bowl, and base.



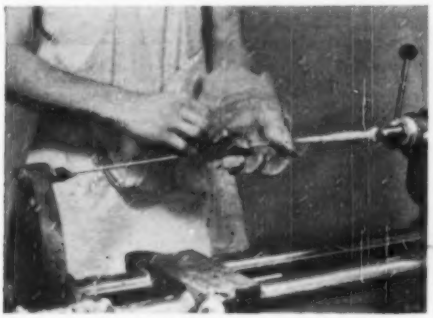

**1 Off-center turning** does the trick, if you want an oval cross section, as in the jewelry box at the left. (The handles and legs are glued on.) Lay out the job as in the inset drawing above, locating the off-centers on the short centerline near the edges. Run block at low speed on one set of off-centers as above and turn down the opposite face. Shift to the others to turn the second face. After this, continue as shown on next page.



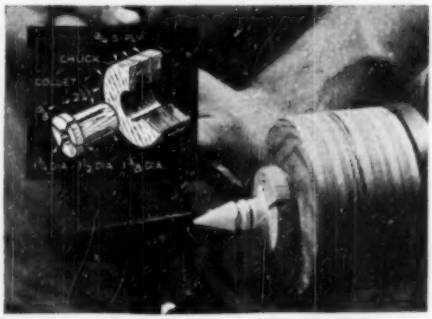
**2 A turning on true centers** rounds off the two remaining faces of the box. (Hollow out the inside, with a chisel and gouge, before gluing up the block for turning. Gluing paper in the lid-body joint provides clean separation when the cover is split off.)

**3 Plane off the blunt arrises** that are left by the final turning. On smaller work, this can be done by sanding. As the last step before removing the job from the lathe, sand it smooth, using a lathe speed slow enough to enable the hands to follow the cam movement.

**In cluster turning,** you use a variation of the off-center method. To hollow out a tray like that above, mount the blank on a counterweight backing, as shown in Fig. 1. After turning out one section, reverse the piece and scoop out the second. Cluster turning can also be used as in Fig. 2 to hollow three or more compartments.



**For a slender turning,** such as this baton, ordinary methods aren't satisfactory because the stick whips violently. But managed as shown here, there's nothing to it. After roughing it out with chisels, reduce the shaft with a block plane, using the gloved hand to encircle and steady the piece. Steady it while sanding, too.

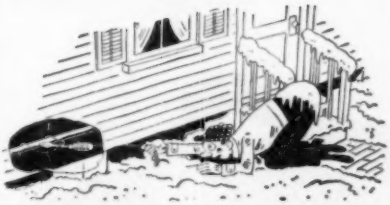



**A drive collet like this** is useful for turning finials, plugs, and other small objects. Turn the chuck from a glued-up plywood stack. Bore it slightly tapering or bellmouthed. Make the collet of hardwood, tapering it to fit chuck. Bore the collet after driving it into the chuck. Make saw kerfs at right angles. The pinching effect of the jaws when driven into the chuck holds dowel stock firmly. END

## Feeler Stops Backing Truck

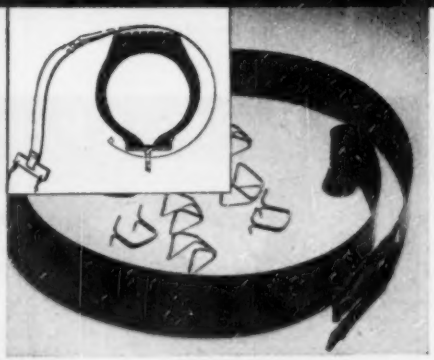
IF THIS truck backs into anything, its brakes automatically lock. The signal is given by the thin feeler rod shown above. This is pushed out behind the rear bumper by a solenoid that is energized when the reverse gear is engaged. If the feeler hits anything, it flexes enough to actuate another solenoid that sets the brakes. They remain set until a forward gear is engaged. If the rear path is clear, the feeler retracts when the truck goes ahead. Peter and Alfonso Fasolino, of Buffalo, developed it.

## *The Height of Ingenuity*



Here was my problem. Our house is built so low to the ground that even a junior-size midget couldn't crawl under it. So when a pipe froze, I had to figure some way to thaw it even though I couldn't get to it. What'd I do?

*I hooked up my electric soldering iron and wired it loosely to the pipe. With another piece of wire, I slowly moved the iron along the pipe until it was thawed.*



## Tool Pulls Chain Around Tire

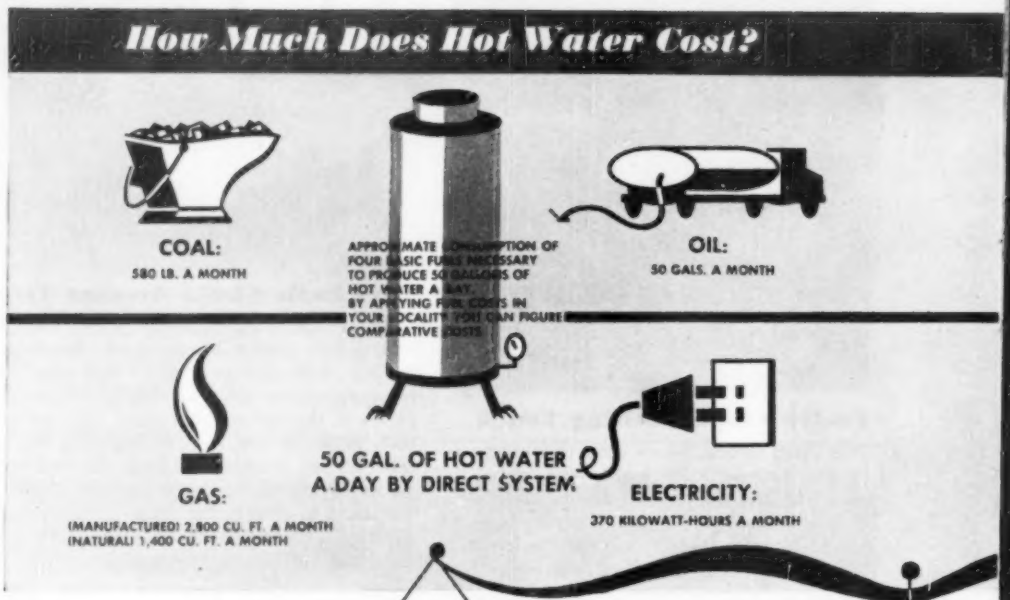
STRAP chains are reported easier to put on with a new tool marketed by J. Randolph & Co., of Englewood, N. J. You start by crimping one of the wire clips shown in the photo on the end of each strap. To use the tool, push the thin end through the wheel slot. As you continue to push, the tool will curve up around the tire so you can hook on the strap, as seen in the drawing. Then pull the tool back in the opposite direction and the strap will follow through the slot. The tool sells for about $1.

## Why Don't Bandits Give Up?

BANDITS who jump this armored truck will get a hot reception from cool guards. Built for Cuba's Treasury Department, the truck body was designed to achieve maximum security plus comfort in a hot climate. Sides and body are lined with 2" of glass insulation, and aluminum paint reflects the sun's rays. The inside body walls are heavy aluminum armor plate. Windshield and windows are bulletproof glass.

## Talc Protects Wallpaper

DIRT and natural oils on the hands can spoil a wallpapering job. Next time you hang paper, rub some talcum powder on your hands. It will help keep them clean and dry and thus prevent soiling the paper. Powder that settles on the paper can be easily wiped off.—*J. E. Bird, Carrollton, Ill.*

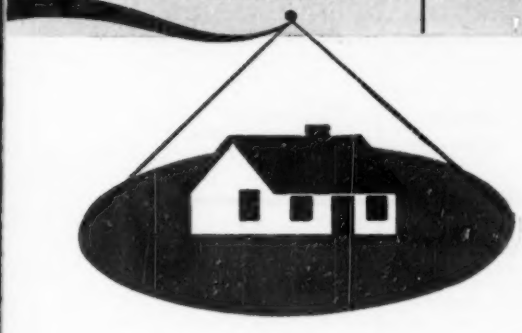



# Measuring Your Home for Hot Water

**By George H. Waltz, Jr.**
*Drawings by Jere Donovan*

***Here's how you can assess a hot-water system by terms of capacity, demand, and comparative cost.***

(FIGURES APPROXIMATE)



MODERN kitchens and laundry rooms are making old-fashioned water systems obsolete. New robot dish and clothes washers have boosted hot-water consumption in many homes, and at the same time improved new heaters have appeared that generate hot water faster and more efficiently.

You can measure your own home for hot water easily. Then, if your audit indicates a new and better system, you can select a heater from a wide array of types to suit the needs of your own particular household. Three major considerations, however, should govern your choice:

- The total amount of hot water your family needs;
- Your existing home heating system; and
- The relative cost of the various fuels in your locality.

Experts estimate that the average requirement per person is about 15 gallons a day. An automatic dishwasher or a clothes washer is likely to require an additional 15 gallons a day. So, by adding up the gallons, the head of a family of four equipped with an automatic clothes washer will find that he should have about 75 gallons of hot water a day available. With an automatic dishwasher, the same family should have about 90 gallons. Since a hot-water system using a storage tank should be capable of storing at least 20 percent of the normal daily needs, this means a tank with a capacity of at least 20 gallons.

There is, however, another factor that's often overlooked. Just as important as your total *daily* needs are your maximum *hour-by-hour* needs. A heater may turn out the total amount you need, but, because its capacity is barely enough or because it heats slowly (experts would say "it has a slow rate of recovery"), it may be inadequate when your wife decides to do several things requiring hot water at the same time.

Theoretically a 20-gallon storage tank can take care of four persons, a dishwasher and a clothes washer. But an audit of

## Direct Heaters

| TYPE | FUEL | ADVANTAGES | COMMENTS |
|---|---|---|---|
| "BUCKET-A-DAY" STOVE | COAL | LOW INITIAL COST | REQUIRES ROUND-THE-CLOCK ATTENTION<br>REQUIRES FLUE CONNECTION |
| INSTANTANEOUS GAS HEATER | GAS | NO FUEL STORAGE<br>NO ATTENTION<br>NO TANK<br>HOT WATER AT THE TURN OF A FAUCET | HIGH OPERATING COST IN AREAS WHERE GAS RATES ARE HIGH<br>REQUIRES FLUE CONNECTION |
| STORAGE-TANK GAS HEATER | GAS | NO FUEL STORAGE<br>NO ATTENTION | HIGH OPERATING COST IN LOCALITIES WHERE GAS RATES ARE HIGH<br>REQUIRES FLUE CONNECTION |
| STORAGE-TANK OIL HEATER | OIL | NO ATTENTION | REQUIRES FLUE CONNECTION AND OIL-STORAGE TANK |
| STORAGE-TANK ELECTRIC HEATER | ELECTRICITY | NO ATTENTION<br>NO FLUE CONNECTION NECESSARY<br>NO FUEL STORAGE | HIGH OPERATING COST UNLESS AREA HAS LOW RATE OR ENOUGH OTHER ELECTRICAL APPLIANCES ARE USED TO GIVE REDUCED RATES |

their hourly needs may show a deficit if Mrs. Jones is in the habit of doing her hair while her automatic kitchen helpers do the clothes and dishes. A hair wash takes about 10 gallons and the automatic washers swallow up another 15 gallons each for a total of 40 gallons within the hour. Forty gallons of hot water must be on tap, and that doesn't mean that a 40-gallon tank will do the trick. It means that 40 gallons must be available and at the right temperature. Under such circumstances, Mr. Jones will be wise to invest in a system that has at least a 50-gallon capacity and a fast rate of recovery.

To play safe, you should gauge your hot-water needs for both the over-all daily total and the greatest hourly demand. Then, the higher figure should be chosen as the minimum capacity. The supplier of a new heater should be able to tell you if its recovery rate is adequate for your needs.

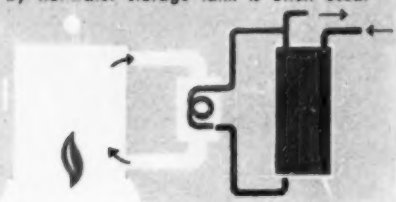
### *Kinds of Systems*

Hot-water systems can be *direct* or *indirect*. In the direct systems, a separate hot-water heater is used, fueled by coal, gas, oil, or electricity. In the indirect systems, the existing home-heating plant is used to heat the water. Most systems—with the exception of the instantaneous gas water heater (direct) and the tankless take-off heater (indirect)—use storage tanks.

If your house is heated by an oil- or gas-fired steam or hot-water furnace, you can use either a direct or an indirect system to

## Indirect Heaters

*Internal coils* make hot water as by-product to regular furnace operation. A nearby hot-water storage tank is often used.



*External coils* located near furnace may heat water indirectly. Output is almost always fed to a storage tank nearby.

*Tankless heat-exchanger type* has more extensive coil system, and transfers heat fast enough to eliminate need for a tank.

get hot water both summer and winter. If your furnace does not have a built-in hot-water coil, one can be added externally to service a storage tank, or a tankless heater can be piped into the system. The tankless take-off supplies hot water directly to the faucets without storage. In either case, an over-riding thermostat can be installed to operate the furnace just enough during the summer months to heat the water without heating the house.

If your furnace is not automatic, or is the hot-air type, you have no alternative but to use a water heater that is a complete unit within itself (direct type). Here, your choice extends all the way from the familiar "bucket-a-day" pot or laundry stove and storage tank to automatic oil, gas, or electric heaters. What you choose will depend on how much you want to spend for the initial installation, how much water you need, and local fuel costs.

Gas and electric hot-water heaters are usually economical only where rates for gas or electricity are low, or in cases where other gas or electric appliances are used sufficiently to put you on a highly reduced cubic-foot or kilowatt-hour rate.

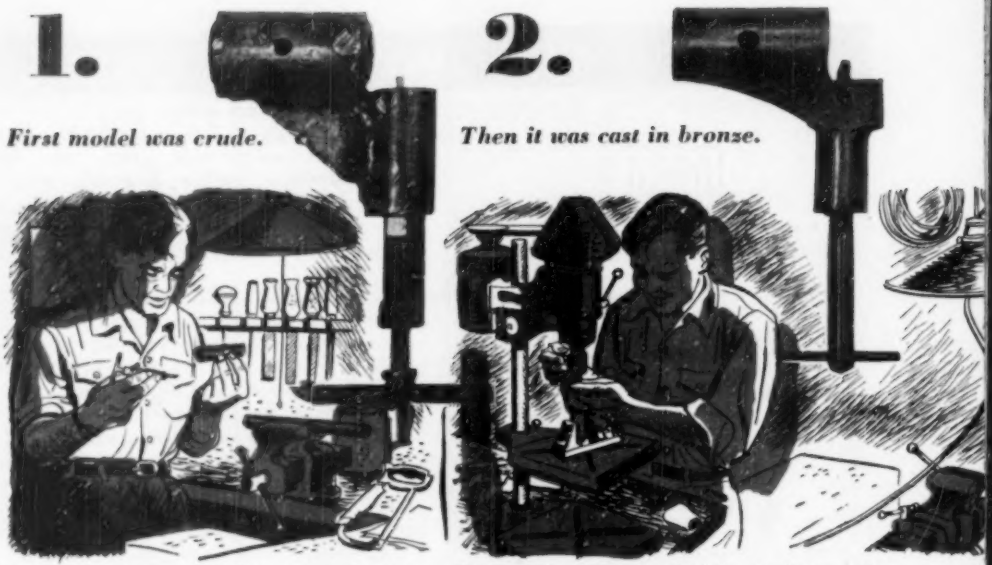
### *Protecting Against Corrosion*

Your best choice of a storage tank also may depend on where you live. Storage tanks are made of galvanized steel, glass-lined steel, copper, and Monel® metal. The best material for your installation will depend on the make-up of the water supply in your locality. If it is excessively hard or soft, it's probably best to avoid galvanized tanks. However, some protection can be had by inserting a magnesium protective rod in a galvanized tank. (The magnesium corrodes and a protective film is formed on the steel tank walls.) Many manufacturers of water heaters now include protective rods in their galvanized tanks. Magnesium rods also can be bought for existing tanks.

Your careful choice of metals should extend beyond your hot-water tank. It is risky, for instance, to attach a copper pipe directly to a galvanized tank. Galvanic action, like that in a battery, will be set up between the two dissimilar metals and will eventually destroy the galvanized metal. If you *must* connect copper piping to a galvanized tank, insert a short length of galvanized pipe between the copper piping and the tank. The worst that can happen then is the eventual breaking down of the galvanized nipple, which can be replaced easily.

High operating temperatures also can shorten your tank's life by stepping up the rate of corrosion. For this reason, it's rarely wise to try to boost your hot-water supply by boosting the temperature. A tank having a larger capacity is a better solution.

Basically, the whole problem selecting a dependable and adequate hot-water system is one of matching and balancing—matching its capacity and recovery rate to your maximum water requirements, balancing your choice against the furnace system you have, and balancing the convenience of various fuels against their costs. Finally, be generous when figuring your family's hot-water needs. No household ever suffered from too much hot water. END




**Two pieces of pipe** welded to a triangular piece of flat steel formed the body. The object was to make an accessory so a wood lathe could be used to cut off ½" steel bars. It worked fine.

**Friends liked it** and asked for duplicates. So the inventor made pattern and had bronze body cast. But tool had a weak point. A screw fed in bit, but it had to be pushed back by hand.

# Inventor Tells How New Tool Was Born

**By Ray Millholland**

Editor's Note: *Ray Millholland of Indianapolis is a well-known writer who invented a tool for home workshoppers. This is his story of its birth and development.*

ONCE there was a basement mechanic who needed a dozen pieces of ½" cold-rolled steel, all cut off square in 6" lengths. A metal-working lathe would have done the job in jig time, but, as is the case in many home workshops, none was available. So a special self-guiding cutting tool that could be attached to a wood-working lathe, a drill press, or a grinder was devised.

The body consisted of two short pieces of pipe—one to hold the cutting tool; the other, the stock—welded at right angles on a triangular gusset of flat steel. A lathe-tool bit was centered in one pipe and melted babbit cast around it. This produced a sliding guide for the bit. In-feed pressure for the bit was provided by a strap-iron arm tapped for a ¼"-20 machine screw.

A stock guide was formed in the other pipe by holding a piece of ½" bar with its centerline even with the cutting edge of the bit and pouring babbit around it.

To cut the rod, it was fitted into the stock-guide end of the tool, which was slid along it to the six-inch mark. Screwing the bit gradually into the rod then made the desired cut. Two and a half hours after the need arose the 12 steel pieces had been cut.

Because friends liked the tool, an improved model was produced. In this, the holes for stock and tool bit were bored to exact diameter in a cast-bronze body. By inserting the proper bits, you could turn multiple diameters with this version.

More improvements were made in a third model. The tool bit was mounted in a cylindrical slide, with a keyway to keep the slide from turning. A graduated collar provided in and out micrometer adjustment of the bit. A knurled clamp screw locked it.

## 3.

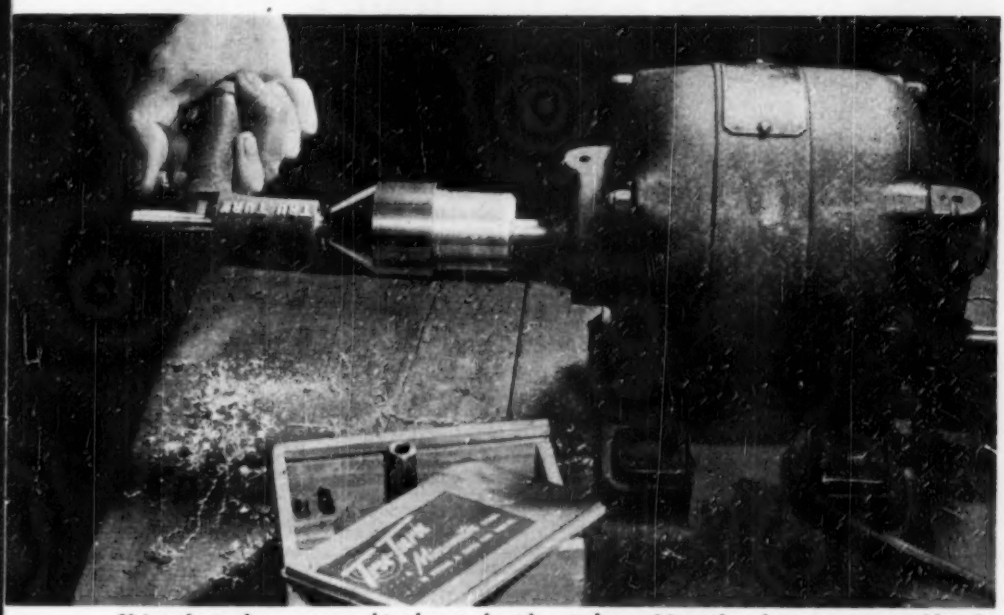
*Action was improved.*

**Positive adjustment** of the tool bit, both in and out, was achieved in the third version. A cylindrical slide was installed to carry the bit, and a knurled locking screw was added.

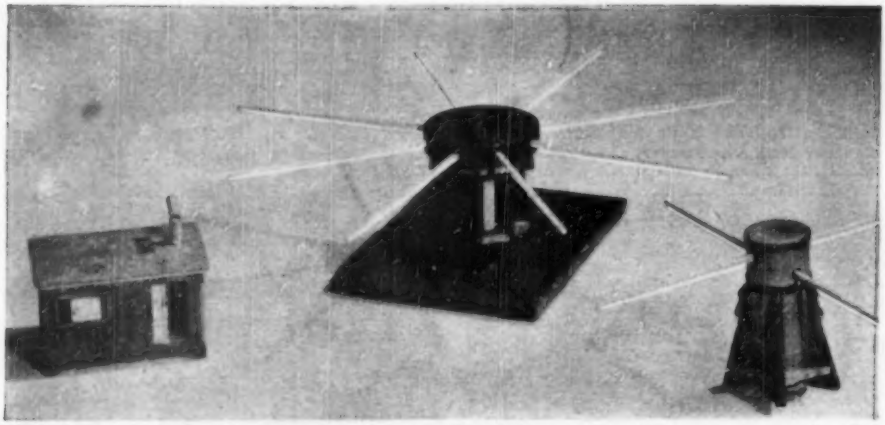
## 4.

*Redesigned to sell.*

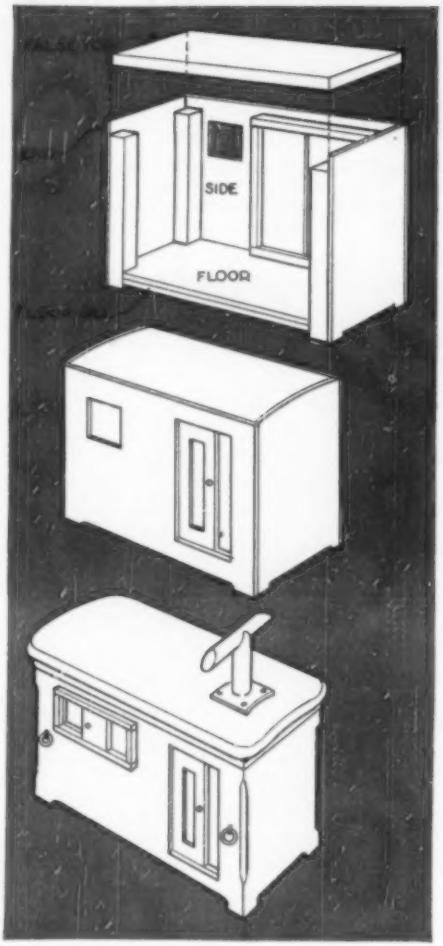
**Manufacturer then agreed to take it.** But first the body was redesigned for more eye appeal, and adapter bushings were added for taking ¼" and ⅜" stock. Thus, at last, it went to market.



**Using the tool,** you can machine bar stock with the simplest of equipment. Here, a ½" bar is held in a chuck locked to a motor shaft. With this, you could either cut off the stock or turn it down. More often, however, you would probably want to use tool with a drill press or wood lathe. The Tru-Turn®, as the tool is called, was described in PS, Dec. '47, p. 195.



**Finished models** above are a type of galley (left) that was lashed to deck or hatch of sailing ships, and two kinds of capstans (right).




# Deck Fittings for Model Ships

MAKING deck fittings is a tricky job. Here are some hints from Winthrop Pratt, Jr., celebrated model builder of Dorchester, Mass.

**Wooden bitts** as small as 1/16" square can be made by cutting a slot with a file or saw and dropping in the crosspiece and filler piece. Use glue to hold the parts.

**Galleys like one at left,** common during 18th and first half of 19th Centuries, were about 6′ by 8′ or 10′, and were lashed to deck or hatch by ringbolts in each corner. To make one, glue corner posts to ends, and glue floor sills, on all four sides, to posts. Cut out door and window openings in both sides. Doors slide in channels inside galley, windows in channels outside. Center drawing shows galley with false top in place. True top overhangs sides. Molding is glued under overhang. Fit chimney but don't put it on until galley is painted.

**Capstans** of the type shown at A were in use during the 17th Century. Note that there is only one row of chocks—at the bottom. The bars go clear through the drumhead as in the 16th and early 17th Century capstan, shown at B. The latter capstan, you'll note, has no whelps.

**HOW CAPSTANS BELOW ARE PROPORTIONED**

Diameter of the barrel equals 2½" for each 10' of the ship's keel.

Holes for capstan bars are about 4' above deck.

Drumhead diameter equals capstan height.

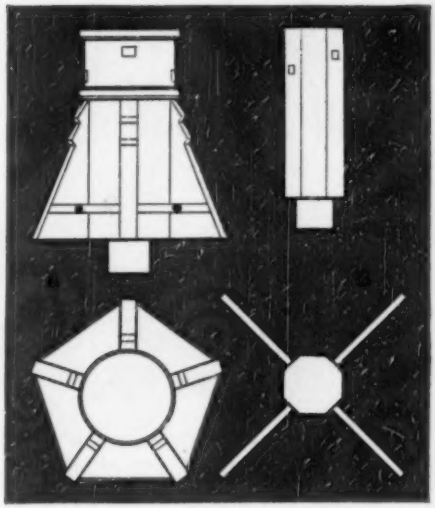
Thickness of drumheads on heaviest capstans equals ⅓ diameter of barrel; on lighter capstans, as little as 1/5.

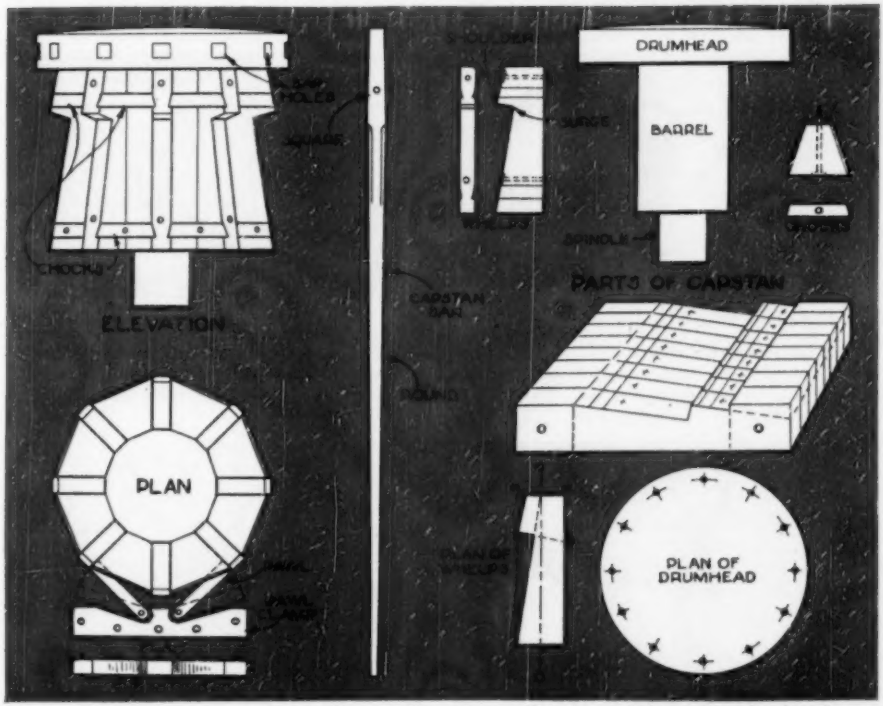
Width of whelps (vertical ribs) at bottom and shoulder is ½ diameter of barrel.

Whelp thickness equals 1/6 barrel diameter.

Thickness of chocks is same as whelps.

Holes for bars scale 2½" to 3" square.

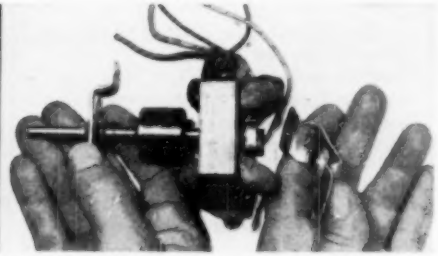



**Capstans like this** were common from early 18th to middle of 19th Centuries. Turn barrel and drumhead from one piece of hardwood. Leave spindle on bottom to set in deck. Mark locations of bar holes and whelps. Make whelps as shown, cutting on dotted lines. If pieces are too small to be nailed together, bind with tape and put them in vise for sawing. Rabbet sides of whelps for chocks. Grain of wood for chocks must run from whelp to whelp. Whelps are glued and nailed to barrel. Install chocks singly. It's hard to make them interchangeable.

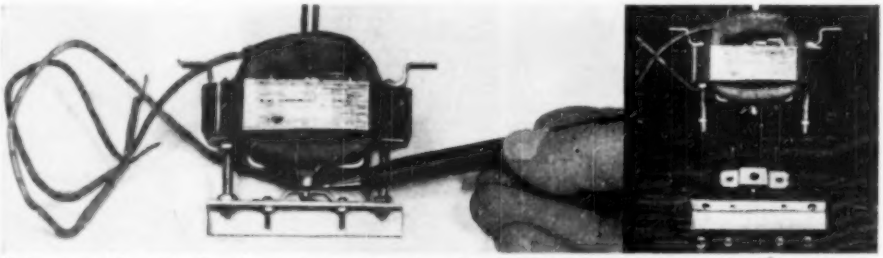
# Hints for Users of Small Motors

INEXPENSIVE small 115-volt shaded-pole induction motors are a convenient source of light power. They'll handle scores of jobs—running working models, action displays, small fans. Sometimes you must adapt the motor to a particular job. Here are ways to do it.—*A. C. Porter, South Bend, Ind.*

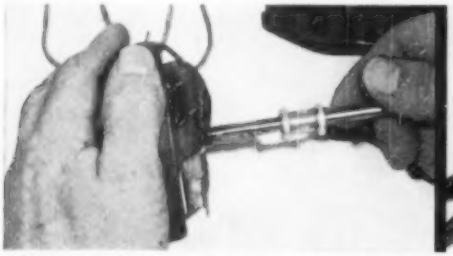


**IF it rotates the wrong way,** chances are you can simply switch the motor end for end. But if for some reason that isn't feasible, you still aren't licked. Just take the motor apart, as shown above, and insert the rotor with the shaft out the opposite side of the frame. That does the trick. The shaft now rolls in the opposite direction.

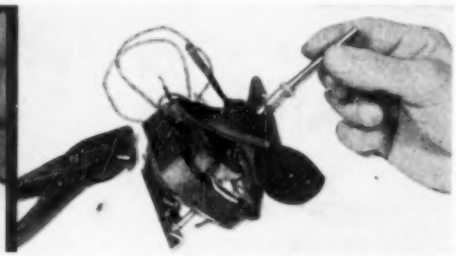
In horsepower rating, these motors range between 1/60 and 1/150. A ¼" shaft is a common diameter and the motor usually runs at about 3,000 r.p.m., depending on the load.



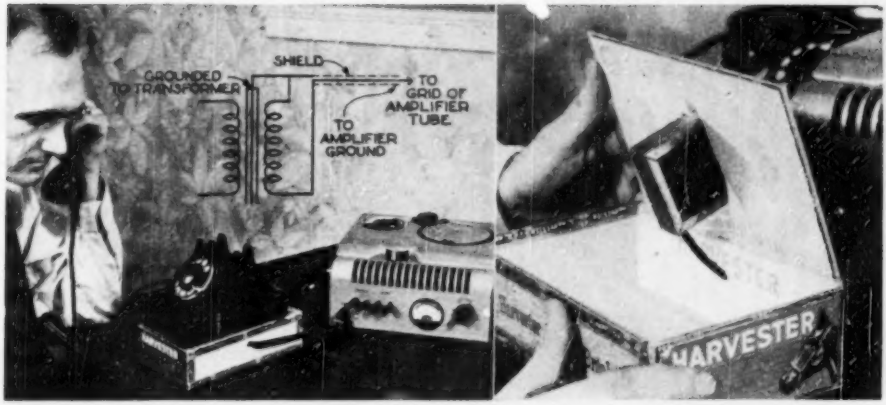
**IF mounted vertically,** the motor may need a thrust bearing under the end of its shaft. That's easy, too. Start with a small steel ball. Centerdrill the shaft end so it will partially conform to the contour of the ball. Support the bearing with a metal angle, held in place by the machine screws that keep the motor together. A thin brass bracket, with a hole in its center, retains the ball. For lubrication, put an oil-soaked felt washer under the ball and against the metal angle. The assembly and parts are shown here.



**IF the shaft is too short,** go to a radio-parts store and get an extension shaft and ¼" coupling. Select the type of coupling that's made as a split bushing, threaded on each end and fitted with two nuts to clamp the two shafts securely together.



**IF it gets too hot,** as it probably will if run a long time, mount a cooling fan on the shaft. A windshield-defroster fan is just the thing. Don't skip the fan, for these motors usually are designed for intermittent duty and may overheat in continuous service.




## Simple Rig Picks Up Phone Conversation

An audio or output transformer with a high-impedance winding, a cigar box, and a piece of shielded wire can be made into an inexpensive magnetic telephone pickup. With it and a wire, tape, or disk recorder, you can record both sides of a phone conversation. (Be sure to let the other party know his words are being taken down, for there are strict laws about unauthorized wire tapping.) You can also hook the pickup to a radio or audio amplifier so several people can listen. The device won't make the phone company unhappy, either, because you don't have to tamper with their instrument, which is also illegal.

Mount the transformer inside the box and connect the shielded wire as shown. Try different transformer windings till you find the best one. One side is connected to the transformer frame and the shield—which acts as the ground conductor; the other side of the winding goes to the amplifier grid. Call up a friend. While he's talking, move the phone over the box until you locate the loudest signal, and mark the position.—*J. A. Rademacher, Fargo, N. D.*

### Paint Car Tools to Stop Rust

Jack handles, lug wrenches, and other emergency tools that lie unused in the car for long periods won't be rusty and messy to handle if they are given a coat of paint occasionally.—*C. E. Wilkinson, Peru, Neb.*

### Gripper Keeps Tubes in Place

The danger of tubes or other plug-in parts shaking loose from portable radio equipment is largely eliminated by the Top Hat® retainer pictured above. Made in a variety of sizes, the retainer fastens to the chassis and grips and holds the top of the tube or other component.

### Wash Car Often in Winter

Many owners wash their cars regularly during warm weather, but tend to neglect it when winter comes. Actually, winter washing is much more important. Many communities use salt-abrasive mixtures to melt street ice and snow. Unless this is frequently washed away, it may damage the body paint.

### Meter Tests Ear-Aid Batteries

A simplified voltmeter for both A and B batteries used in hearing aids is being made by Telex, Inc., of Minneapolis. Eliminating wire leads makes the meter easier to use; spring contacts on the arms automatically orient the batteries for testing.

# Mystery Engine Breathes Flame

**Give yourself a capsule course in machining by building this lively model. Then ask your friends what makes it go. Few of them will know.**

***By Harry Walton***
*PS Photos by W. W. Morris*

CHANCES are neither you nor your friends ever saw an engine like this. Guesses will run wild when you ask others how it works, and most of them will be dead wrong. Substantial and good looking, it has a lively pop as you turn it over by hand, and it has the staccato roar of a small gas engine when it's running at speed.

It will readily operate light model machinery and toys. Fitted to a turntable as on page 177, it makes a fascinating shop-window display. In tests it has run 40 minutes on one filling of its small lamp. But don't expect it to turn a heavy load or run a model speedboat. Like a gas engine, it delivers full power only at higher speeds, and its weight makes it awkward for use in small model boats.

Not only is this baby engine fun to operate, but it's a top-notch project on which to break in a new lathe and get the hang of basic machining operations, involving as it does layout, boring, turning, facing, simple milling, drilling, and tapping. The photos on these pages show how Floyd McGuckin, of Ridgewood, N. J., did the whole job while PS looked on.

You can make the engine out of scrap, turning the cylinder from solid cast iron, bronze, or dural, and building up a base. However, castings save a lot of shopping and machining time. Those who would rather spend a few bucks than many hours can inquire of Mr. McGuckin.

The whole job can be done on a bench lathe, although a drill press will speed up the job. Only one tap and one die (6-32) are required. In addition to engine stock, you'll need a length of 1 1/16" bar for a mandrel, and a 3½" disk of any metal for the jig on which the valve cam is turned.

The cylinder casting can be gripped in a three-jaw chuck; but since it's not balanced, lathe speeds must be kept reasonably low. Take a heavy first cut with a husky boring bar, feeding by hand, to get under the hard scale. Light cuts and power feed

IT ROARS AS IT RUNS, the alcohol flame dances furiously, and a lance of fire stabs into the port through the rapidly working valve. This mechanical teaser is an atmospheric engine, also called a vacuum engine.

The first patent on the type was granted to an English inventor in 1823. Pressure generated by a coal-gas explosion in his engine escaped through check valves, which closed as the pressure fell below that of the atmosphere. Then water was injected, cooling the remaining gases and further lowering the pressure, so that atmospheric pressure shoved the piston back.

A few such engines were built, but they were cranky and costly to run. More successful was the Otto and Langen engine, used in large numbers in England and Germany from 1863 to 1876.

In this, a free piston was shot upward in a vertical cylinder by the explosion, which did no other work. But as the gases cooled and atmospheric pressure pushed the piston down, a toothed piston rod turned a pinion, and through it the shaft. A ratchet device let the pinion turn free on the shaft during the upstroke.

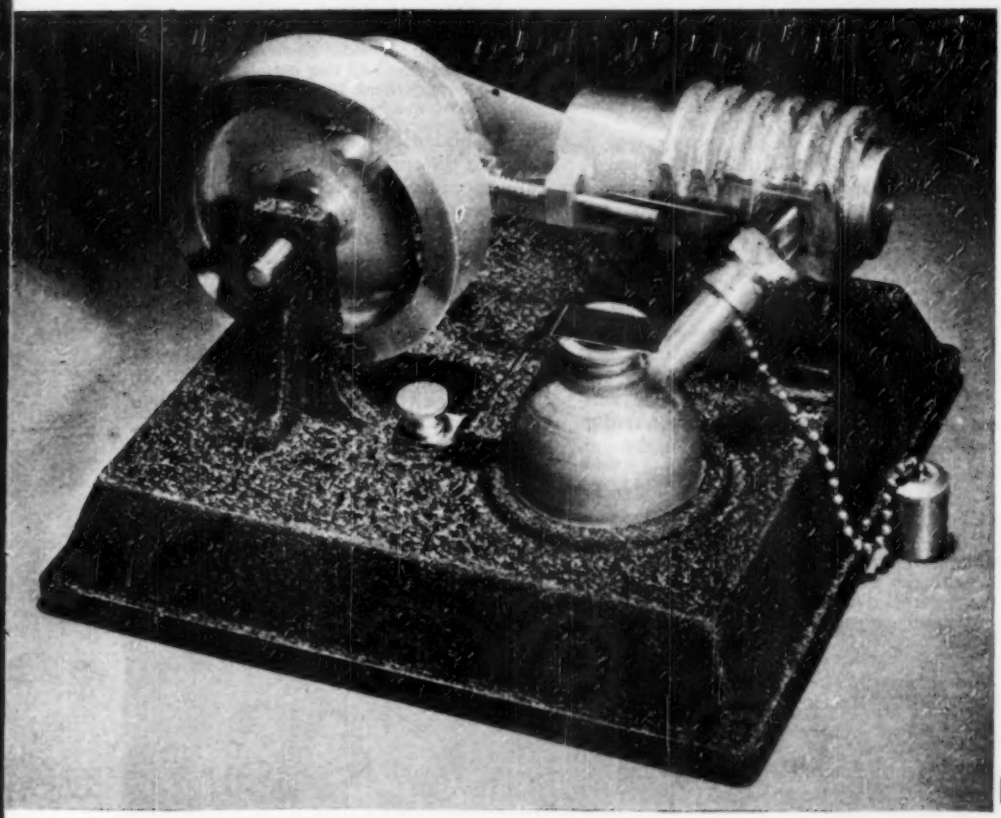
The piston of the engine shown sucks in hot gases from the flame. Just before bottom dead center, the sliding valve closes the port. Losing heat to the cylinder walls, the gases contract and leave a partial vacuum. Atmospheric pressure pushes the piston inward. This is the power stroke.—*Joseph Tracy, Manhattan, N.Y.*

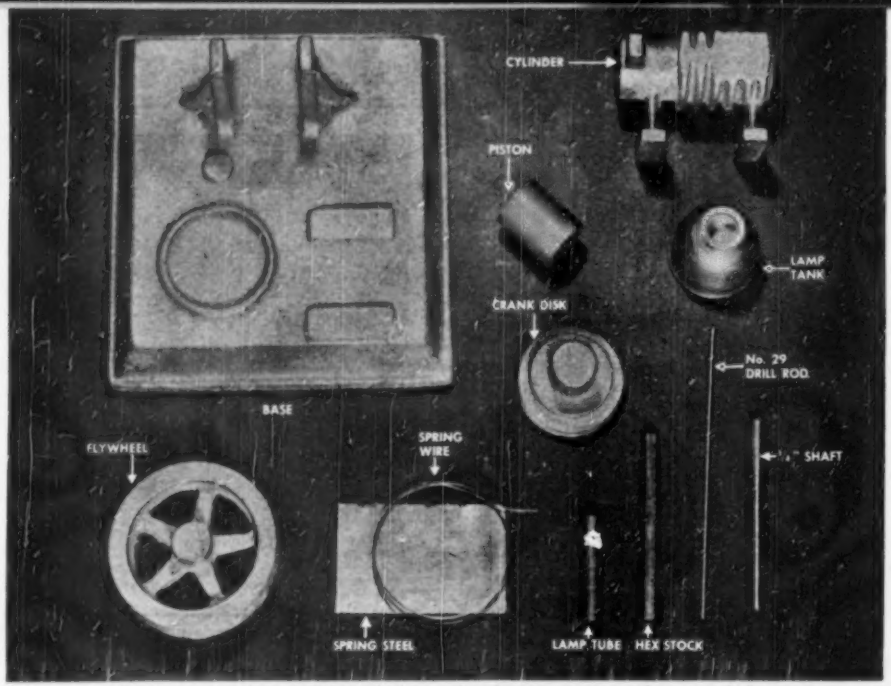
***Meet Floyd McGuckin***

THE expert who builds the engine in the pictures on the following pages comes by his talents naturally. His father invented the Spintite® wrench and numerous other automotive and optical tools.

Floyd has been running a lathe since he had to stand on a box to reach it. In his neat basement shop in Ridgewood, N. J., he has developed some inventions of his own. Among these are a friction-testing machine, a microscope stage for measuring fine textile threads, a photocell gadget to count the particles in colloidal graphite, and a tattooing system that unerringly identifies racehorses. When not inventing something new, he manufactures telescope eyepieces and other optical parts, makes special dies, and builds fixtures for use in his work.

Like every good machinist, he has worked out some shop dodges of his own. PS plans to bring you some of these from time to time.






**You can build** the engine from solid stock, but a set of castings like this saves time and work. The cylinder is cored. Flywheel casting has handsome square spokes. Stock for engine parts even includes small oil can from which alcohol lamp to supply heat to run engine is made.

should be used to bring the bore to size. A tapered bore, or bellmouth, will be fatal to good performance. It's important to get a free-running but reasonably airtight fit between piston and cylinder. The cast fins require no turning.

If the port face is roughened in filing the port, you should lap it dead smooth. This can be done by rubbing it on a fine oilstone, but be careful not to rock the cylinder and so round the surface.

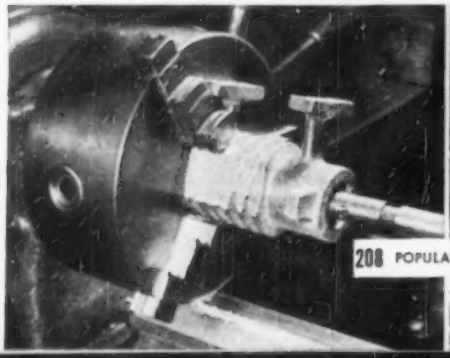
If you haven't a drill press, spot the bearing holes on both uprights, drill them undersize, and run a ¼" drill or reamer through both at once to bring them into line.

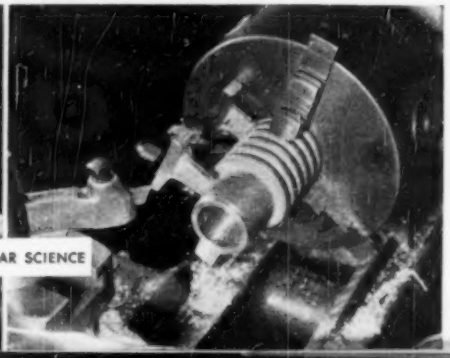
Probably the trickiest piece of work involved is the combined crank disk and cam. Take special care in laying out the 15/32" offset center and the 30° angle on the jig, since these determine the valve timing. This part is a press fit on the shaft. After turning the cam profile, round its sharp corners with a file. Then rechuck the piece on the 2" diameter as at the top of page 211. Put the ¼" crankshaft in the tailstock chuck and press it in by advancing the ram with the handwheel. This trick helps you get the disk on square.

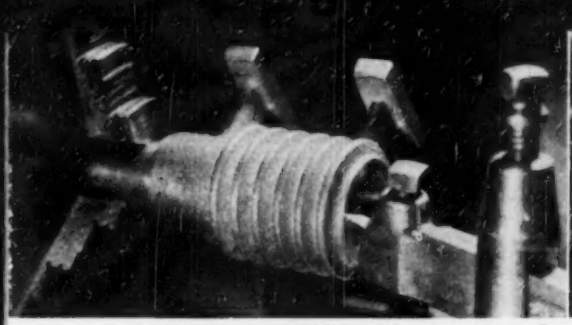
Be sure to turn the bottom of the piston cavity flat so that the wrist-pin stud will

**1 Cylinder is firmly chucked** like this for boring, with jaws straddling the flat side. Using a husky boring bar, take a deep first cut to get under hard crust of casting. Keep subsequent cuts light to avoid boring a taper.

**2 Make last boring pass** without advancing tool, using medium speed and finest power feed. Then face end of cylinder and valve guide. With care, you can also face one side of both feet now, as shown below.

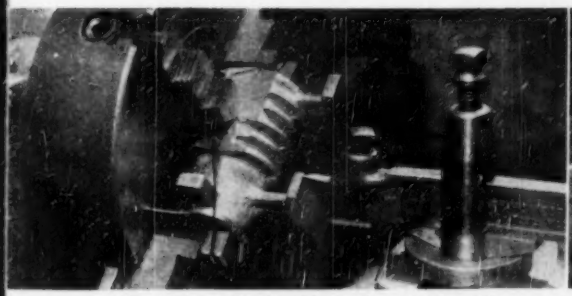




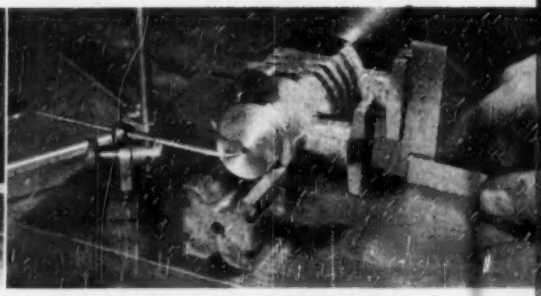


**3 Chuck a piece** of bar stock, turn to 1", and file enough taper to allow cylinder to be pushed on tightly at least two thirds its length. Face for cylinder plug as shown. Then reset the tool to face other sides of both feet.

**4 Put cylinder** in four-jaw chuck, with square bar inside resting on opposite chuck jaws to insure parallelism of port face with bore, and with feet at 90° to chuck face. Wire the bar fast for safety. Turn port face true and smooth.



**5 Turn cylinder** 90° and rechuck with same bar inside and port face under one jaw. Use aluminum, copper, or brass pads under jaws to protect finished surfaces. Again secure bar with wire. Then face bottom of both feet.

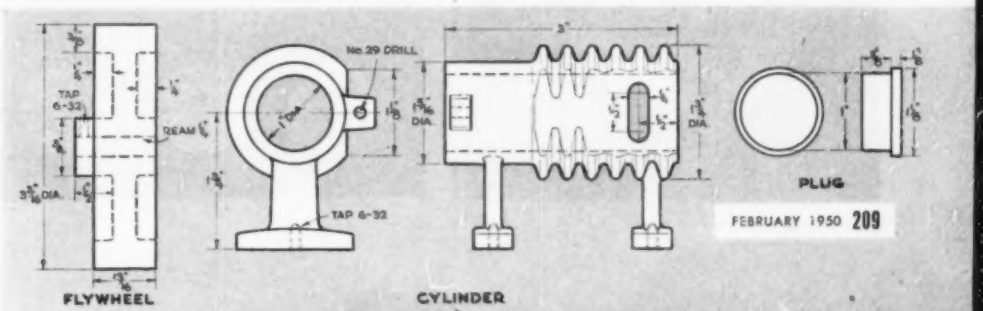


**6 Mandrel previously used,** centerdrilled and filed to a push fit, supports cylinder on V blocks on a surface plate or piece of plate glass. Set surface-gauge scriber on mandrel center, square feet, scribe centerline on them.

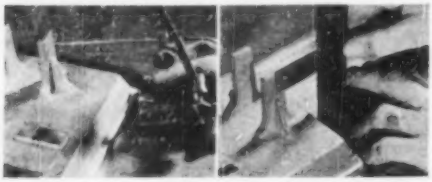
seat squarely for an airtight fit. Since all the engine's power is derived from atmospheric pressure, a good piston fit is vital. But this must be obtained without undue friction. With the cylinder plug in, the port covered, and the cylinder only lightly oiled, the piston should offer real resistance to a pull, and should snap back by itself when released. If you have means of "miking" the cylinder, you can turn the piston about one thousandth undersize. If not, use the cylinder itself as a gauge. A couple of shallow oil grooves can be turned in the piston if you like.

McGuckin uses an impromptu milling setup for slotting the wrist-pin stud. Turn the stud with a little pip about 1/16" in diameter on the face. Set it up as shown,

**7 To mark centerline** of port and valve guide, stand cylinder on its feet and reset surface gauge to mandrel center. Prick-punch and drill two 15/64" holes ½" apart as at left above. The intervening metal can then be milled out or simply filed away as shown at right. Be careful to make port to size. Clean up any burrs left inside the bore with a fine file. If port face is rough, lap it perfectly smooth on a fine, flat oilstone.

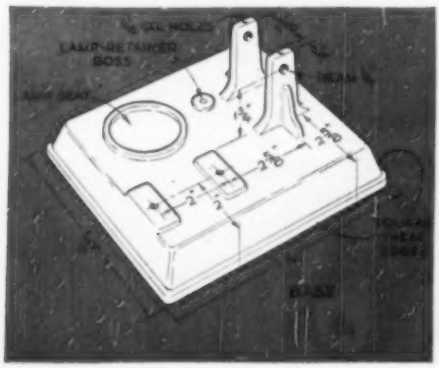


**8 Grind scale** off cylinder bosses and file smooth to identical height, checking with surface gauge. File two edges of base nearest bosses and bearings square with each other.



**9 With base and surface gauge** on a surface plate or piece of plate glass, set hooked end of scriber 2" in from one squared edge to scribe centerline on cylinder bosses. Reset gauge at 1¾" above bosses and scribe bearing height as in photo at left above. With square and rule, measure from the other squared edge to center of nearer boss. Subtract 2⅝", and measure the difference from this edge to scribe bearing location on uprights as at right above.

**10 If you have** a drill press, only the outer bearing (farthest from cylinder) need be spotted. Tilt drill-press table 90° and chuck rod. Square up a bar against this, clamping the bar firmly to the bottom table edge. Resting squared edge of base on the bar, slide base and swing table on column to align drill with bearing center. Clamp base firmly to table. Start with a center-drill; then run through 15/64" drill and finish with a ¼" drill or reamer.



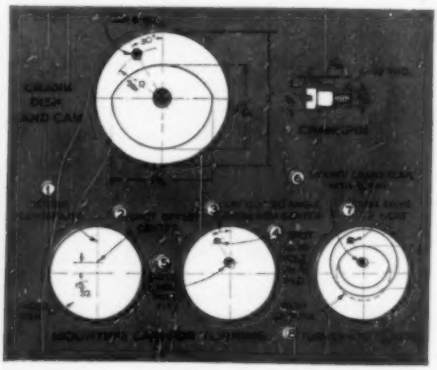

aligning it with the slitting saw by bringing the stock against the saw before clamping the tool holder. This also insures cutting the slot across two corners of the hexagon. Line up the pip with the saw; it gives you an aiming point, and, if you don't hit center the first crack, you've cut only into the pip, not the stud. A similar setup mills the valve and con rods.

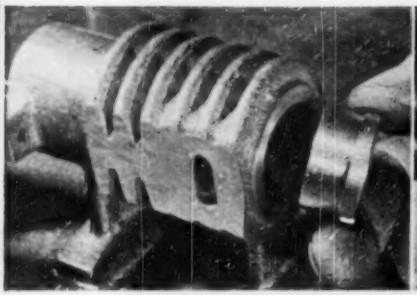
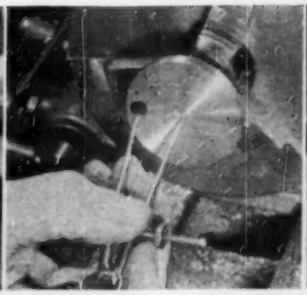
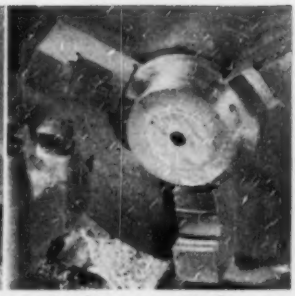
It's a good plan to cut the con rod a bit long and file it to size after a trial assembly. At top dead center (all the way in the cylinder) the top of the piston should come flush with the edge of the port nearest the flywheel. When threading the end of the con rod, it's also well to open up the die, if it's adjustable, to give a full thread. This makes the big end a tight fit and helps keep it in alignment with the wrist pin.

Heat the .010" clock-spring stock red hot and let it cool very slowly. So annealed, it won't crack. The valve clip is meant to provide a flexible coupling without horizontal play, and also to hold the valve gently on the port face. You'll have to anneal the small end to drill the rivet holes, but try to leave the center portion hard.

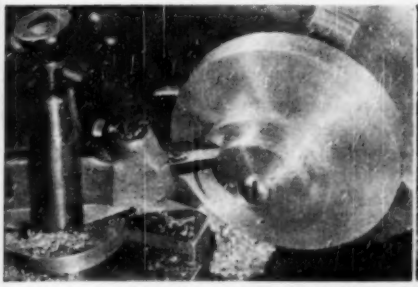
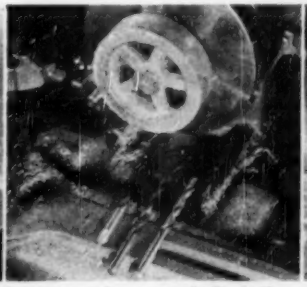
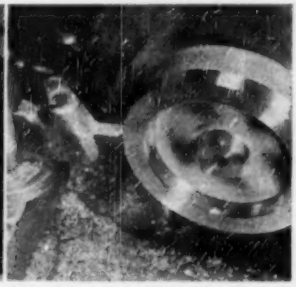
After laying out the fork on 1/16" stock, drill a ¼" hole at the end of the slot. Saw to the hole and file the edges true. Don't drill the hole for the valve rod until you've bent the short leg. Turn the roller from steel. Shoulder down a bit of ¼" rod to fit the roller; then put the roller on to locate the end of the shoulder, thread, and cut off.

By assembling the valve and piston actions separately, you can make sure both run freely. If the piston binds, check the parallelism of crankpin and wrist pin. With all parts assembled, the valve should lift with a pop as the flywheel is spun forward (counterclockwise from the valve side).

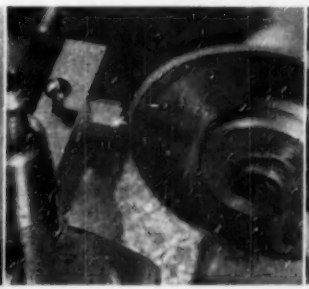
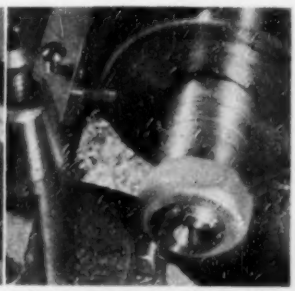


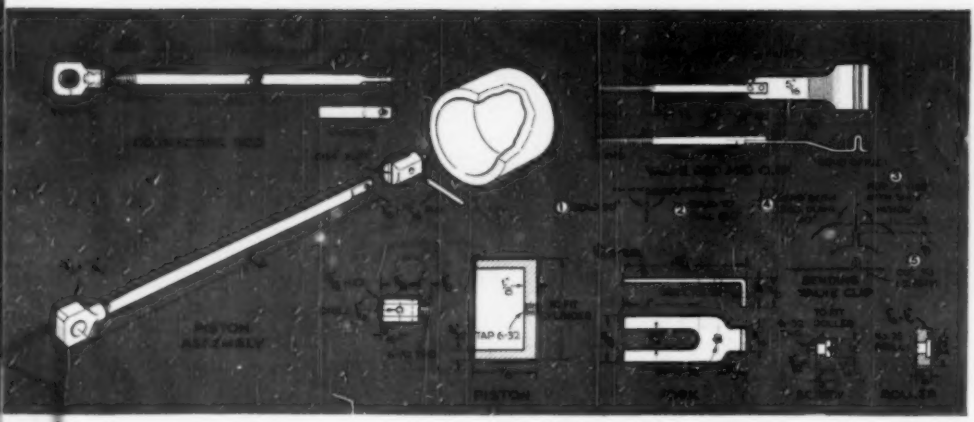
**11 Holes are drilled** in base bosses and matching holes are drilled and tapped in cylinder feet. A plug turned to a tight fit is filed to a slight taper and driven in (left above). First step in making crank disk and cam is to grip casting by its chucking spigot and face off and turn 2" diameter. Centerdrill lightly to spot crankpin circle at ¾" radius with dividers (center photo). At same chucking, turn 1⅝" diameter of cam behind and face rear of 2" diameter to 3/16" thickness. Centerdrill more deeply and drill to a drive fit on the ¾" crankshaft. Remove from chuck and rest on rear face of crank disk to drill No. 36 crankpin hole. Saw off the spigot. Then rechuck with the cam diameter out (right above) and face off cam to ¼" width.

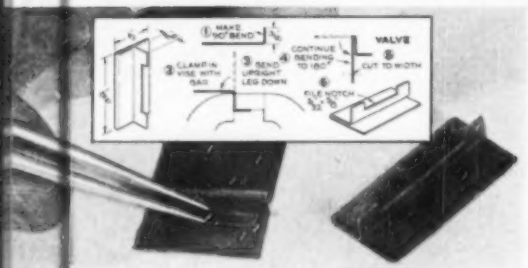
**12 Face off a 3½" disk** of brass or other stock and scribe a diameter with a sharp bit. Lay out offset center as in drawing. Mount crank disk with two short pins or small pin and screw threaded into jig. Turn cam to 1 11/64" width. File sharp corners round. Chuck flywheel by inside of rim, with chuck jaws against the spokes so that rim doesn't touch them. Centerdrill, drill undersize, and finish with ¼" drill or reamer. Next face the hub and rim. Turn outside of hub and inside of rim, and finally outside of rim as at right above. File slight chamfer on corners. Then reverse in chuck, using outside jaws to grip on finished rim. Face other side and turn inside of rim and outside of the hub.

**13 Piston is simple,** but must be carefully fitted for good performance. Bore out first, forming flat bottom inside. Drill and tap 6-32. Turn outside to a close push fit in cylinder. Lap with crocus or other fine abrasive cloth to a good running fit, without shake. Shoulder down hex stock for wrist-pin stud, thread, and reverse to face off, leaving a tiny pip at center. Screw stud into bar and clamp into tool post, hex corner up and pip at lathe-center height. Align pip with a .064" slitting saw and feed in to cut slot (center photo). Hold con rod in hole in bar with a setscrew, align parallel to saw by running rod against its side, and mill flat on both sides to 1/16" width, as at right. Mill the flat on the valve rod in the same way.



**14** **Big end** of con rod is turned from flat bar or hex stock. Shoulder end, tap 6-32, and cut off. If your 6-32 die is adjustable, open it to cut tight threads on rod, which is best cut a bit long and then trimmed to fit.




**15** **Anneal .010" spring steel** and bend valve as shown in diagram above. Bend valve clip as in drawing at top of page. Scribe to length alongside bend with dividers, shape narrowed shank, and rivet to valve rod.

**16** **Lap valve perfectly flat,** first on fine emery cloth laid on plate glass, and then on an oilstone. The valve parts are shown below in order of assembly, except for 6-32 adjusting nuts, which clamp the work between them.

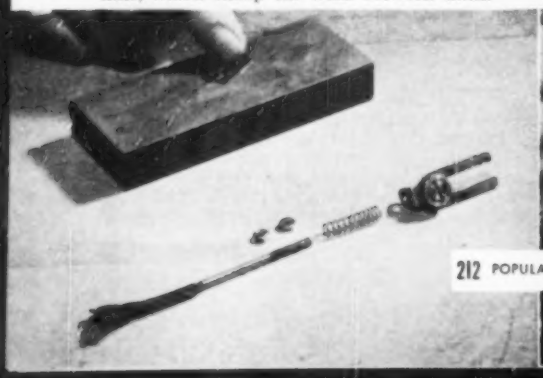
When turned backward, the piston should resist and snap the wheel back if released.

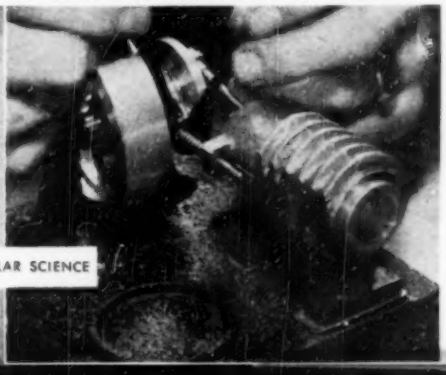
Make a hole in a small oil can or similar container and solder in a bit of ⅜" i.d. tubing to hold a soft string wick just below the port opening. Bend a retaining clip from spring stock and mount it on the base with a thumbscrew. Pull out enough wick to give a flame about 1¾" high.

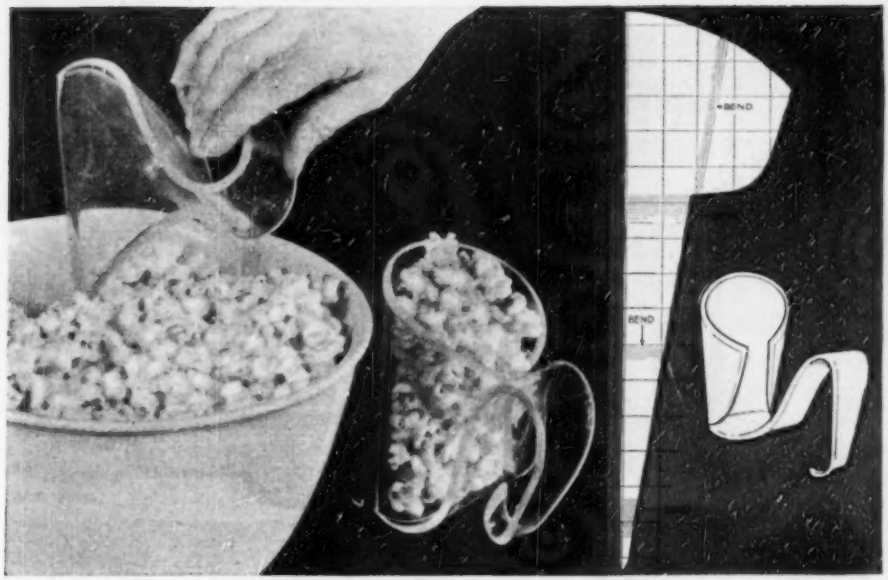
To start the engine, turn it to top dead center and give it a hearty spin forward. Turn the lamp in the base ring for best operation; flame position can be critical.

If piston and valve seem reasonably airtight and the engine is mechanically free but won't run, or has little pep, check flame height and valve action. The port should be fully uncovered just past top dead center. If the engine picks up just after the piston is oiled, it's probably leaking air. Lapping the port face, if you haven't done so, may improve operation. Friction must be held to a minimum. The valve should bear very lightly on the port, and valve-spring tension must not be excessive. END

**17** **Adjust valve** so that it overlaps the port only 1/32" when fully closed. Clip should exert little pressure on port face. Use washers to align cam with roller if necessary. Engine runs clockwise as seen from crank end of shaft.







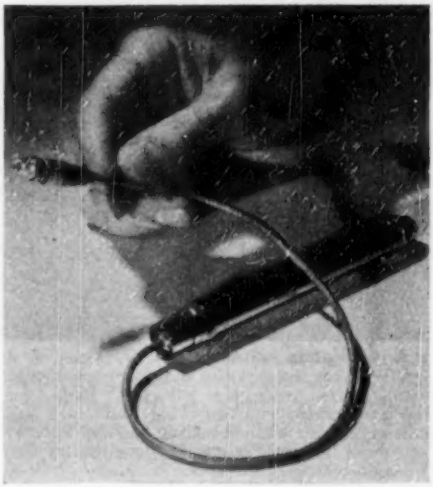

## How to Turn Plastic Scraps into Popcorn Scoops

You can make a set of plastic scoops for popcorn from a few scraps of ⅛″ clear or colored plastic. For each one, enlarge the scaled pattern (only one half is shown) and trace it off on the masking paper of the plastic. Jigsaw to the outline and smooth the entire edge with file and sandpaper.

Strip off the masking paper and put the plastic on a flat surface such as a cookie sheet. Heat it in the oven at about 275° to 300° F. When the plastic is limp and pliable, remove it from the oven with gloved hands and bend the sides around to form a cup. Bring the long tapered part up to the top edge, then curve it back toward the bottom to form both a handle and a rest. Hold the plastic with both hands while it cools and sets.—*Doris Aller, San Francisco.*

### Wire Extends Flashlight

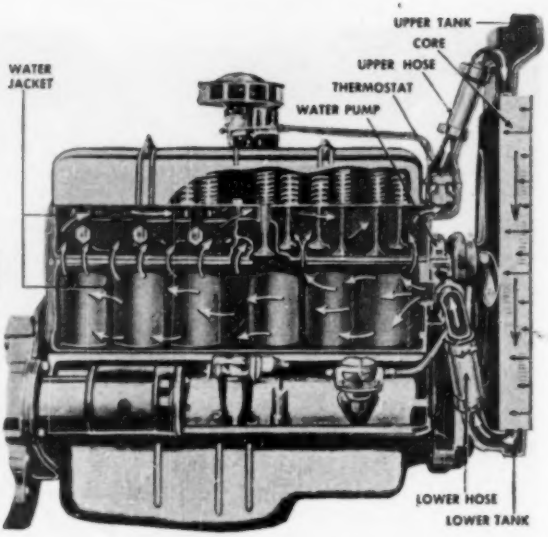
A TROUBLE-SHOOTING light that will get into tight corners can be made by extending the bulb of an ordinary flashlight as shown at the right. Solder a miniature socket to one end of a length of shielded wire, using the conductor and shield for the contacts. Break off the base of a flashlight bulb and solder it to the other end of the wire.—*Milford Ames, Des Plaines, Ill.*



### Turning Work to Small Size

If you have to turn a relatively long piece to a small diameter, make the final cut a heavy one. By taking a 3/32″ cut on a 5/16″ rod, you can bring it to ⅜″ diameter in a single pass. The 5/16″ thickness ahead of the tool is strong enough to withstand the cut, and the ⅜″ behind is not under strain.

# How Your Car's Engine Is Cooled



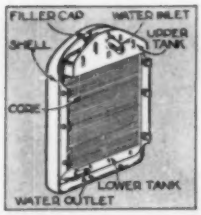

**Three simple home experiments suggested by Kenneth M. Swezey.**

ALTHOUGH heat makes your car go, too much would quickly bring it to a halt. Left unchecked, the intense heat of combustion would soon warp and burn the valves, break down the oil, overheat the bearings, and "freeze" the pistons to the cylinders.

Part of this excess heat passes out the exhaust. The cooling system takes care of the rest. A typical system is shown in the drawing above. Urged on by the pump, water circulates through the jacket, picking up heat from the combustion chambers, valves, and cylinders. Then it carries the heat to the radiator, releases it to the air, and returns again to the water jacket.

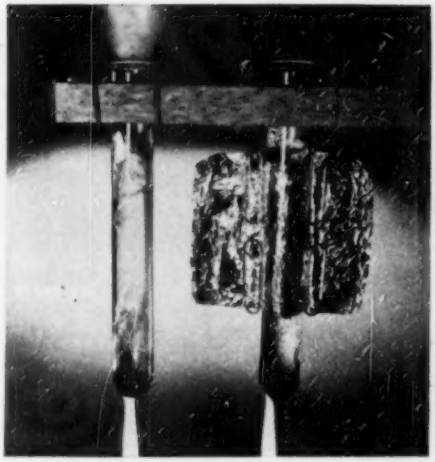
To learn at first hand a few more facts about the cooling system of your car, try the simple demonstrations on these pages.

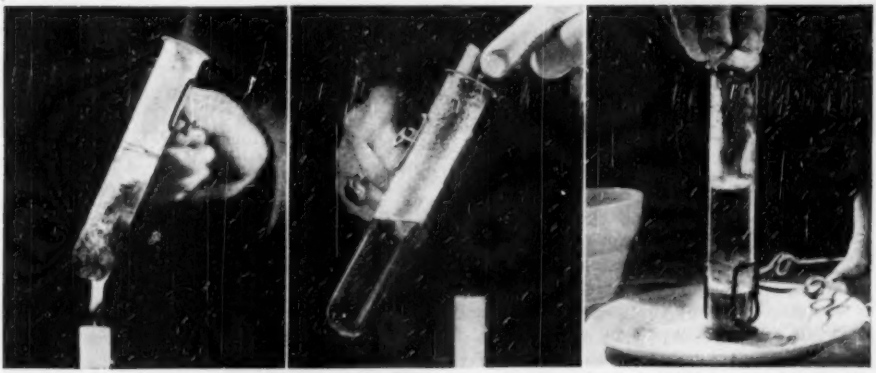
**How can plain water** keep your engine at a safe working temperature despite much higher temperatures inside the cylinders? Partly for the same reason you can bring water to a boil in a paper cup without setting the cup afire. If you don't believe this can be done, try it. Use a single-bottom cup, about a quarter full of water. Hold it over a candle flame, and the water will soon boil. Why doesn't the paper burn? Because the hot water keeps it cool. The paper gets hot, it is true, but the water carries off the heat before it rises to kindling temperature. In like manner, water circulating through the engine carries off heat from the working parts, preventing them from being distorted, or even melted, by the combustion heat.




**How does the radiator transfer heat** to the air? After collecting in the top tank, hot water from the engine passes down through the core. The core's function is to divide the water into many small streams and expose each to air drawn through the radiator by the fan and forward movement of the car. As the air rushes past copper fins on the water tubes, it takes up heat from the water inside the tubes.

**How fins help cool water** can be shown with the setup in the photo at right. Attach broad fins of heavy aluminum foil to one of two identical test tubes. Put the same amount of water in each tube and hold them over identical candle flames. The water in the plain tube will soon steam. The other will take longer because it loses heat to the air through the fins.





**Why are pressure cooling systems** now used in most cars? Strangely enough, you can find the reason on a mountaintop. A few years ago, when all cars had nonpressure systems, radiators often boiled at high altitudes. Why? Because of the drop in atmospheric pressure.

At sea level, the boiling point of water is 212° F. When you climb a mountain, atmospheric pressure drops and the boiling point drops. The experiment above shows this.

Fill a test tube half full of water. Bring it to a vigorous boil, quickly stopper the tube, invert it, and apply cold water with a wad of wet paper. This condenses the steam inside, causing a partial vacuum and reducing the pressure. Although cooled, the water begins boiling again. In a pressure cooling system, this works in reverse. Since the system is airtight, the steam that's generated exerts pressure on the water, raising its boiling point above 212°. This permits the engine to operate at a more efficient higher temperature without boiling.

## Waxed Nails Hold Securely

Some nails that you buy are wax-coated for better holding qualities. Recently, unable to buy a supply, I coated some common nails myself. Dissolving 1½ lb. of rosin in a pint of liquid paint drier, I dumped this solution and two kegs of nails into a tumbler made from an old oil drum. Then I gave the tumbler a few turns and took out the nails.—*John E. Heisson, Fitchburg, Mass.*

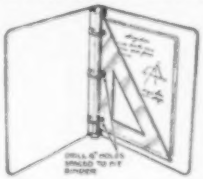
## White-Lead Putty Won't Bleed

If you have trouble with ordinary putty "bleeding" through your paint and showing up as yellow spots, try a homemade putty that is free of this trouble. Into a small can of white lead stir some powdered whiting. Add a little at a time until the mixture has the consistency of putty. The whiting can be worked in best with a spatula or knife.—*Joseph E. Bird, Carrollton, Ill.*

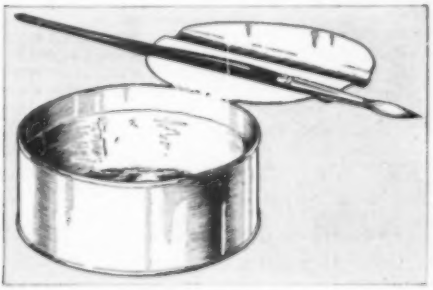
## Adhesive Bonds Wall Anchor

By using these new anchors, you can mount cabinets, towel racks, or other fixtures on masonry, tile, or other surfaces without drilling holes. The Miracle Surface Anchor®, a perforated metal plate, is attached with a special adhesive. Plates are available with various attachment devices—nails, bolts, spindles, threaded studs. Goodloe E. Moore Co., of Danville, Ill., is the maker.

## Triangles Held in Book



Drafting students and others who have occasion to carry plastic triangles may find this tip useful. I insert mine in my looseleaf notebook by drilling holes to fit the rings. This way the edges are protected and the triangles won't be mislaid.—*H. L. Orwig, Wilkinsburg, Pa.*



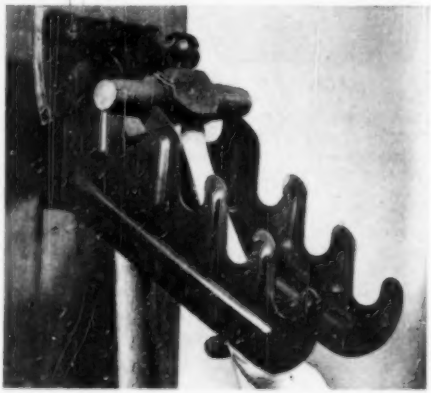
## Tin Can Holds Paint Brushes

A tin can makes an excellent container for washing small brushes, and the lid can be used to hold wet ones. Open the lid with a roll-type opener, leaving a hinge portion. Bend a couple of hollows in the lid with pliers.—*Frank Shore, Manhattan, N. Y.*

## These Coasters Won't Stick

When you pick up a drink, these coasters are guaranteed not to ride along too. Made of metal, the coasters have a felt base to protect your furniture.

A product of the J. H. Cristil Co., of Edgerton, Ohio, the coasters sell for about $3.50 for a set of eight. They're made in colors to match Perma Hues® aluminum-alloy tumblers, also shown above.



## Holds Shop or Garden Tools

Five of your household, shop, or garden tools can be hung out of the way on this simple pressed-steel rack. It is priced at about $1 by the Jim Brown Toy Company, of Akron, Ohio. The rack is mounted by screws in two slotted holes.

# Home Accessories You Can Build on Your Kitchen Table

**Looks like a power-tool job, but it's not. The parts cost $6.03.**

LOOK for parts instead of finished products the next time you go shopping—and you may discover ways to save money while having fun. Even apartment dwellers without workshops can produce many useful and decorative home accessories by cleverly combining odd items.

On this and the next six pages, Arthur Miller, of New York City, shows you how to put together five attractive pieces—the guest mirror pictured here, a dressing table, a folding wall table, a double-deck sewing stand, and a chandelier.

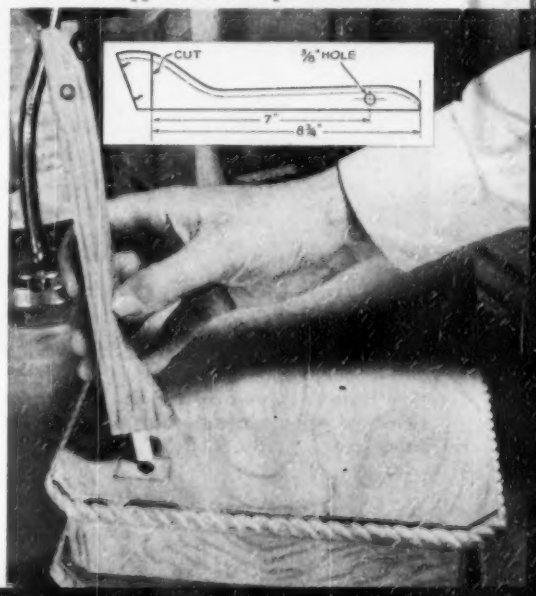
The guest mirror is handy as well as decorative. Place it on top of a chest of drawers and you've got a temporary dresser with a tilting mirror and a drawer for small articles.

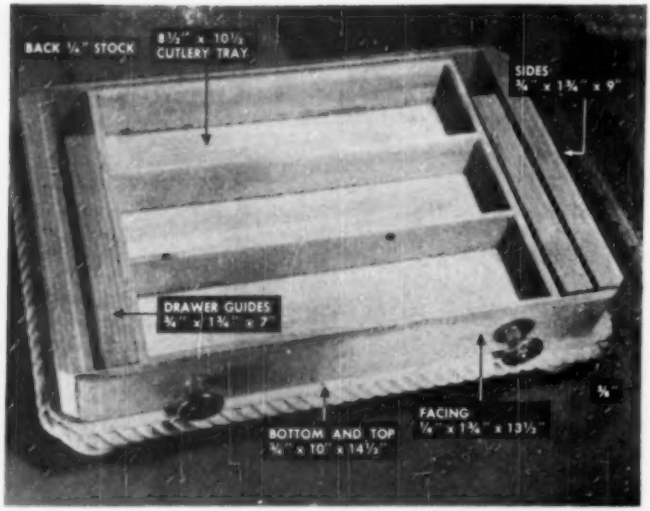
To build it, you'll need:

- Two breadboards.
- Two brass drawer pulls.
- Four wooden drawer pulls.
- Picture frame.
- Cutlery tray.
- Wooden coat hanger.
- Nine feet of ½" rope molding.
- Scrap stock.

A photo on the next page shows construction details of the base. Make saw cuts across each corner of the top and bottom pieces (the breadboards). Then round them with sandpaper. Cut the corners of the sides, back, and drawer facing (made from scrap) diagonally as shown in the photo. Before assembling the base, attach the

**Wooden coat hanger,** hacksawed in two, makes mirror supports. Cut halves as shown below. Mount the supports on the top with dowels.



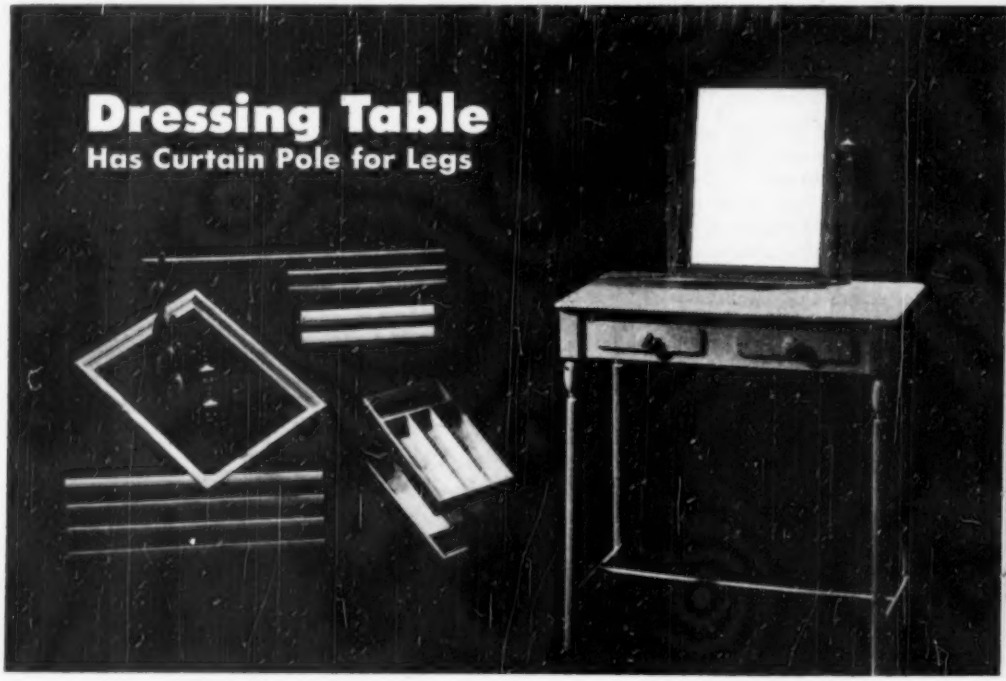



**Here the base is assembled except for the top.** Dimensions are shown on photo. Brass pulls and glue hold drawer facing to the cutlery box.

drawer pulls that serve as feet. These are held in place by screws driven down through the bottom piece.

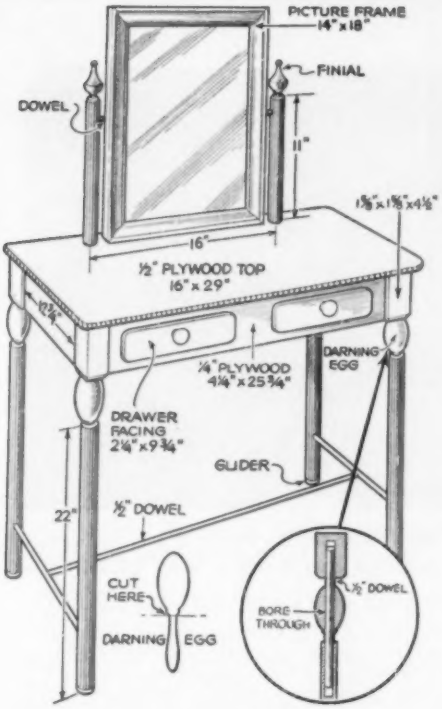
Attach the ½" rope molding with glue and brads. When you come to a corner, saw almost through the molding from the back. Then you can bend it without breaking it. Now assemble the base with glue and nails.

Cut and drill the coat hanger as indicated. You can saw up the hanger's crossbar for dowels to mount the mirror and mirror supports.

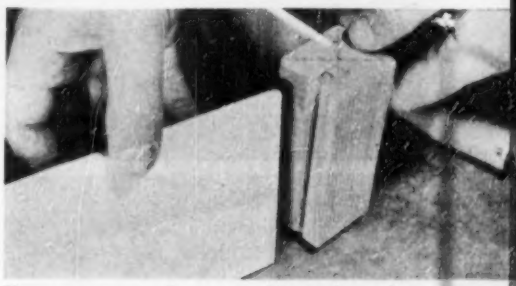



**You'll need plywood for the tops and sides of this project, but the table's total cost is only $10.51.**

HERE's a welcome addition to almost any bedroom. At first glance, construction may look tough, but it's really easy. Dimensions



**Darning egg** can either be drilled all the way through for single dowel (drawing), or handle can be used as one dowel and top drilled for second (left above). Right: grooving a block.



**You can groove the corner blocks** by making two saw cuts and chiseling out the waste. Secure the plywood aprons in the grooves with glue.

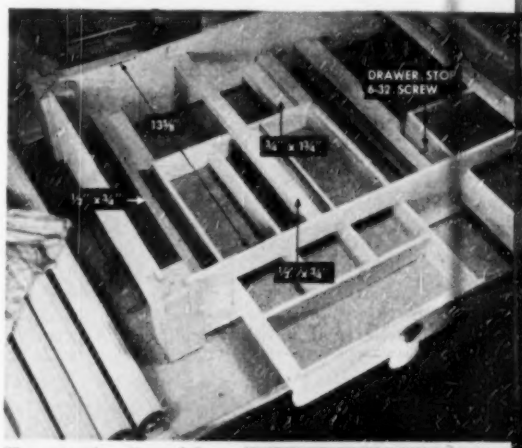
are detailed in the drawing shown at top.

Buy the few dollars' worth of lumber that you'll need at a yard that will cut it to size. The other parts you'll need include:

- Picture frame.
- Two cutlery drawers.
- Two wooden drawer pulls.
- Two fluted curtain poles 11″ long.
- Four fluted curtain poles 22″ long.
- Two small finials.
- Four darning eggs.
- Eight feet of beaded molding.

Many department stores sell the curtain poles by the foot. They'll cut them to length for you. Start by gluing up the leg assembly. While this is drying, assemble the drawer unit with brads and glue. Use a coping saw to cut the openings for the drawers. The ½″ by ¾″ slat above each drawer keeps the drawers from tipping when they're pulled out.

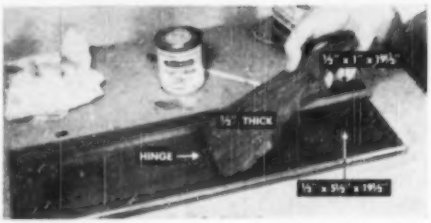
You can saw and chisel the grooves in the corner blocks yourself or have the lumber yard cut them. Glue the plywood apron into the grooves. Attach the beaded molding with glue and brads. You may have to alter the dimensions of the mirror. They'll depend on the size of the picture frame you use. Dowel and glue the mirror supports into the top and you're ready to paint.



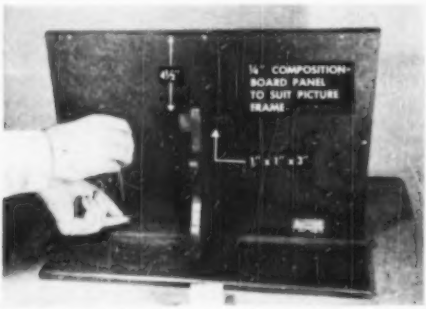

**Here are details** and dimensions of drawer assembly. Drawer facings are held in place by glue and the screws that hold wooden drawer pulls.

**Mirror supports** are topped off by small urn-shaped finials. Drill top of support for finial's dowel. Mirror is suspended by ⅜″ dowels.

# Wall Table
## Folds Out of Way




**Bracket that supports** wall table is hinged in exact center of piece that is screwed to wall.




**Two assemblies** are joined with hinges. Put them on table like this to line them up correctly.

**Up it's a shelf; down it's a picture. Cost of this quickie job: $3.75.**

THIS folding wall table can be used in many ways. If you live in a small house or apartment, it can serve as a buffet in your dining alcove. Or you can mount it in an entrance hall as a spot to park parcels or mail. In fact, you'll find a use for this table in almost any room.

Parts list:

- Picture frame.
- Four small pieces of wood.
- Three hinges.
- 3/16" composition board to cover the back of the picture frame.

The frame measures 12" by 18" inside. Other dimensions are given on the photos.

Nail a ½" by 1" strip along the top of the piece that screws to the wall. Then cut out and hinge the supporting bracket as shown in the photo. Attach a 1" by 1" block with wood screws through the composition board. Next, put a picture in the frame and brad the composition board to the back of the frame. Then hinge the two assemblies together as shown in the bottom photo.

After sanding all parts well, finish the wall table to match your other furnishings. The one shown here was given a mahogany stain and then rubbed well with wax. In mounting your drop-leaf table, be sure it is well anchored to the wall. If the wall is plaster, drill the holes and then insert wooden plugs to take the mounting screws. Use flathead wood screws at least 1½" long and countersink them. You also can use toggle bolts. They're made especially for plaster walls.

# Sewing Stand

## Has Two Decks; Costs only $2.38

**Two salad bowls, a rolling pin, and two coat hangers are all you need.**

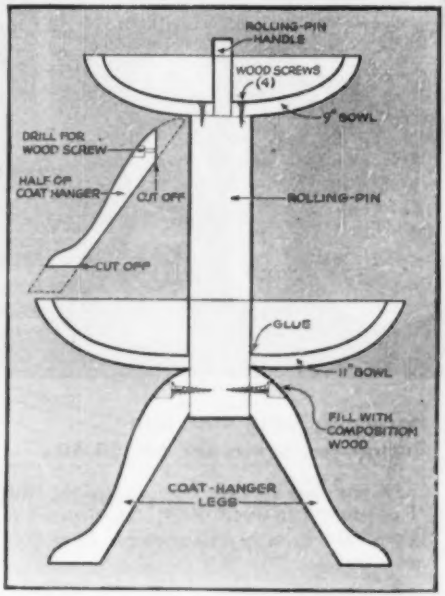
You can build this sewing stand with only three tools—saw, hand drill, and screwdriver.

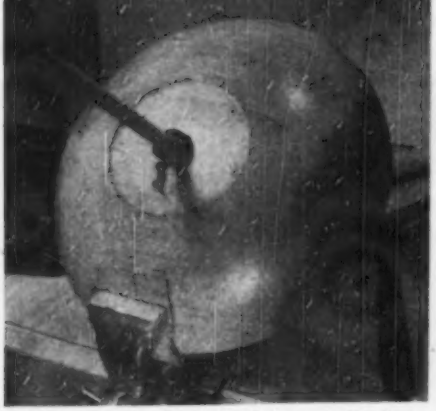
The salad bowls are 9″ and 11″ in diameter. When you shop for them, pick out a pair that match in wood grain and color. A rolling pin forms the central shaft on which the two bowls are mounted. The legs are made from halves of wooden coat hangers.

The first thing to work on is the rolling pin. Saw off one of the handles flush with the end of the roller. Then, on the same end, cut three flat surfaces on the roller. Space these flats equally around the roller. The legs will be screwed on at these points.

Drill a hole in the center of the smaller bowl. Make it just large enough to take the remaining handle of the rolling pin. Four flathead wood screws through the bowl and into the roller hold the smaller bowl in place. Make the hole in the larger bowl a tight fit for the rolling pin. If you don't have an expansive bit for this, drill a circle of overlapping ¼″ holes. Then use file and

**Inverted,** a 6½″-diameter wooden bowl can be used instead of legs if you prefer to make this stand low enough to be placed on a table.





**Drilling smaller bowl.** Lock it in a vise if you have one, but use cardboard to protect the surfaces. Hole should just clear handle.

**Apply stain** to bring bowls, rolling pin, and legs to the same color. Then finish the stand with a couple of well-rubbed coats of wax.

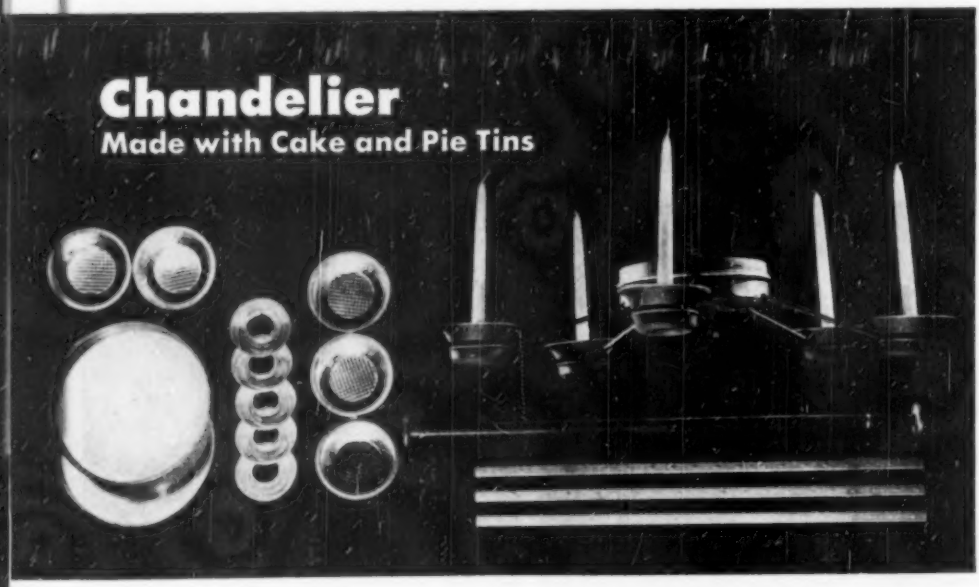
sandpaper to smooth out the jagged edge.

With the bowls on the rolling pin, attach the legs with glue and wood screws as shown in the drawing below. Counterbore for all screws and fill in over the heads with composition wood. The lower bowl rests on the three legs. To secure it, use glue.

After the glue and composition wood have dried thoroughly, sand all surfaces and finish the stand with a stain and wax.

# Chandelier

## Made with Cake and Pie Tins

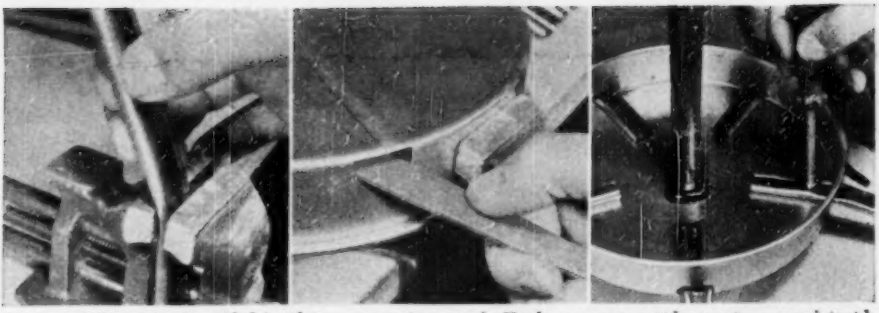


**Here's an Early American design you can make for $3.40.**

If you like to dine by candlelight, this chandelier will serve nicely. And you can buy all the parts in a dime store. Here they are:

- Two 9" cake tins of different depths.
- Three 27" flat curtain rods—the kind that telescope.
- Five 3" pie tins.
- Five 4" individual gelatin molds.
- One adjustable closet pole.

Start by pulling the curtain rods apart. Cut three of the halves exactly in two. Use either the inside pieces or the outside pieces,

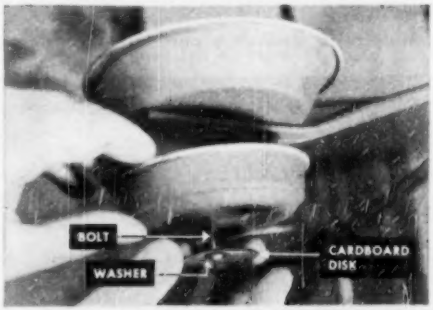


**Arms are bent in vise** (left). Slots are cut in the side of the deeper cake tin to take the arms. Slot is started by punching or drilling small holes. Then opening is enlarged with file (center). Each arm, open side up, is secured inside cake tin by two small bolts and nuts (right). One end of adjustable closet pole is also bolted to the tin. Locate the center exactly for the pole.

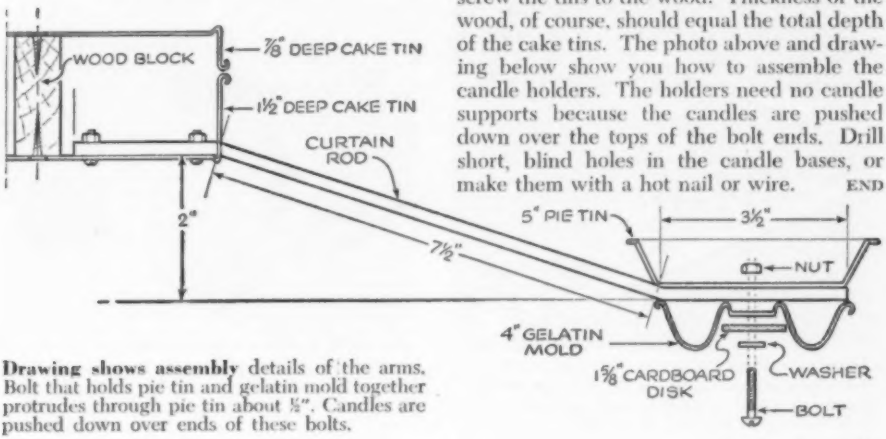
but keep them all alike. This gives you the five arms with one left over. Use the sixth to make experimental bends. Then you'll get the feel for the right amount of pressure when you shape the arms. Each arm is bent 2½" from one end and 3½" from the other end. Bend the arms to the shape shown in the drawing below.

Mark the bottom of the deeper cake pan into five segments. Where the dividing line of each segment touches the circumference, cut slots in the side for the arms. You can do this by punching or drilling small holes and enlarging them with a file. Then bolt the closet pole to the center of the tin. You can find the center of the tin by cutting a circle of paper to fit inside, folding it in half and then in half again, and then placing it, folded, in the tin again. The apex will be at the center of the tin.

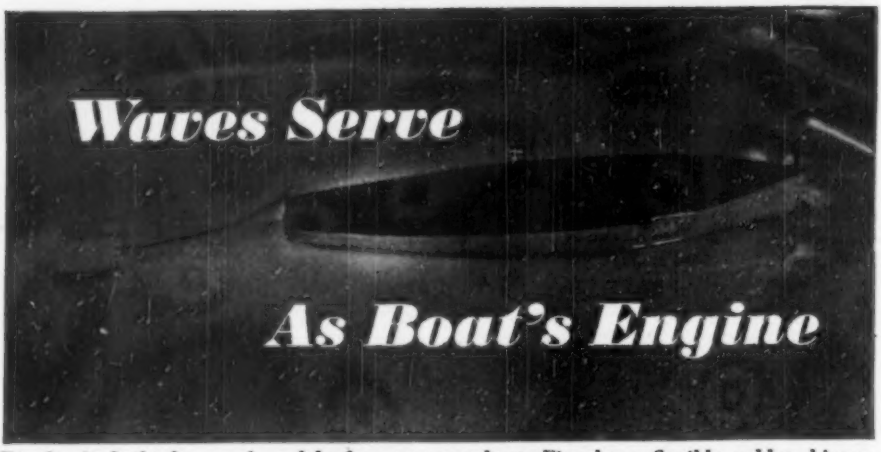
After the arms have been inserted through the slots and bolted down to the first tin, the second cake tin—with a hole cut in the center—is slipped over the closet pole. Place two small pieces of wood inside the tins and screw the tins to the wood. Thickness of the wood, of course, should equal the total depth of the cake tins. The photo above and drawing below show you how to assemble the candle holders. The holders need no candle supports because the candles are pushed down over the tops of the bolt ends. Drill short, blind holes in the candle bases, or make them with a hot nail or wire. END




**Cardboard disk and washer** are slipped over bolt before candle holders are assembled. Disk and washer hold bolt head when nut is tightened.

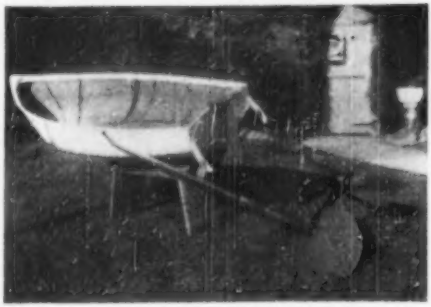



**Drawing shows assembly** details of the arms. Bolt that holds pie tin and gelatin mold together protrudes through pie tin about ½". Candles are pushed down over ends of these bolts.

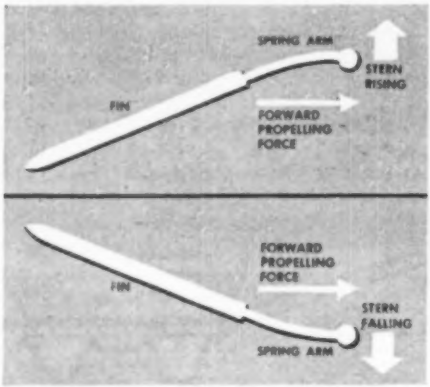


# Waves Serve As Boat's Engine

**Ripples in bathtub propel model of wave-power boat. Fins have flexible rubber hinges.**



**Man-carrying version** of engineless boat, designed by John S. McCubbin, of Victoria, Australia, rides sea by harnessing wave power. A conventional rudder steers the odd craft.

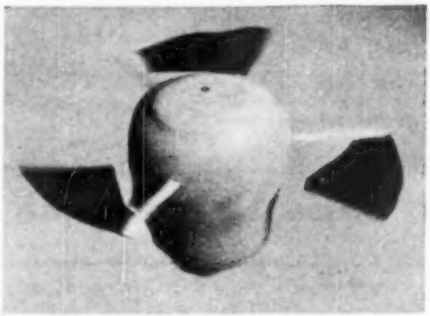



**Diagrams** show ingeniously simple principle of wave-power boat. Fins are flexibly mounted and exert a forward propelling force, as boat pitches, whether stern is rising or falling.

TRAILING a pair of flippers at its stern, this new boat mysteriously propels itself without apparently receiving power from anywhere. The toy-size model above will sail around a bathtub when the water is only slightly agitated. The man-carrying version at left works in a gentle sea.

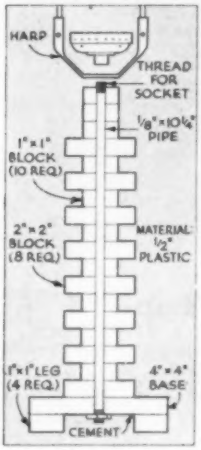
Actually, the mystery boat runs by wave power. When passing waves make it pitch even slightly, the flexibly supported fins turn upward or downward, and exert a forward propelling force as their inclined surfaces follow the vertical movement of the stern in either direction.

The inventor of the novel craft, John S. McCubbin, of Victoria, Australia, also envisions a "wave motor" rotated by flexible fins, shown below, that would harness waves to supply power for machinery.



**Model of rotating float** with flexible fins shows how same principle could be applied in stationary "wave motor." Mounted on shaft, float would supply power to drive machinery.

## Lamp Base Built Up of Plastic




SQUARES of ½" clear sheet plastic cemented one on top of another make up the base of this homemade lamp. The plastic gleams in a beautiful pattern when the lamp is lit.

One 4" by 4" square, eight 2" by 2" squares, and 14 1" by 1" squares are required. After cutting the squares to size from your sheet stock, sand the edges to a smooth finish, and buff and polish to a high gloss. Drill a ⅜" hole in the center of all pieces except the four 1" leg squares. Cement these to the corners of the 4" base.

Slip all the others over standard lamp pipe (called ⅛", actually ⅜" o.d.) and apply cement between. Run the socket leads up through the pipe.—*M. S. Gearon, Chicago.*

## Plastic Squares Bedeck Wood

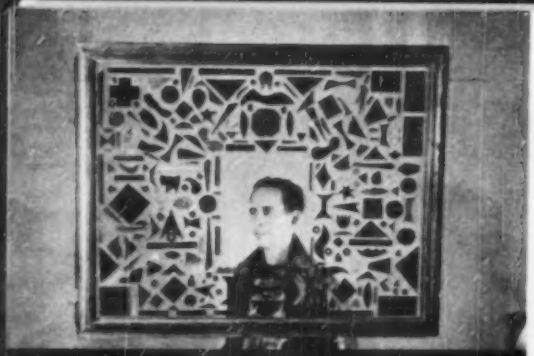
INSTEAD of painting some wood project you've just completed, you might like to try Deks®. These are 4" by 4" squares of a plastic resembling leather. They come in 10 colors and cost a dime apiece.

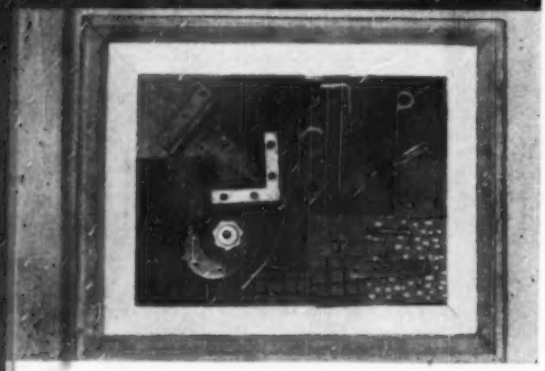
Above, Deks cover a valance board. Other uses include bookends, jewel boxes, hassocks, bed headboards, and mirror frames. An upholstery tack holds each square. Deks, Yonkers, N. Y., is the maker.

## Etched Scene Adorns Plastic

USING a sharp steel needle in a vibrator tool, you can etch decorative scenes on the surface of plastic objects you have made. The plastic box above is an example.

Here, a western scene from a magazine was the pattern. The lid was placed on this, top surface down, and the etching done on the underside. Textile color was rubbed into the etched area with a soft cloth, then cleaned up with a clean cloth. A wax crayon could also be rubbed in for the color. —*O. L. Woolley, Colorado Springs, Colo.*





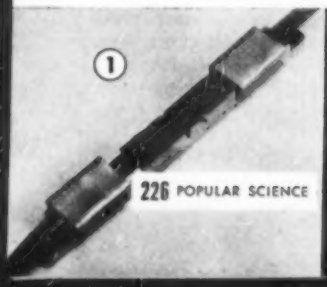
## Hardware Serves as Paint

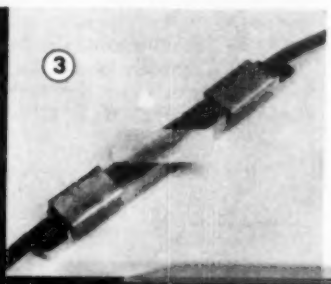
MECHANICAL odds and ends are now being used to teach art. To obtain greater flexibility in non-objective composition, Philadelphia instructor Leonard Nelson developed the "Gismo." It consists of a large picture frame with a metal background and a handful of bar magnets. A large assortment of household objects and variously shaped, brightly painted free forms cut out of sheet iron complete the equipment. The magnets, placed behind the frame, hold the oddly shaped pieces fast to the metal.

Cut-out paper forms have been widely used in teaching non-objective art. But they are likely to be blown around unless pasted down. When the "Gismo" composition is arranged—and rearranged—to the satisfaction of both student and teacher, the final effect is recreated in conventional materials.—*Walter Fischman, Manhattan, N. Y.*

## Splicer Simplifies Editing of Magnetic Tape

QUICK, clean, noiseless splices of magnetic recording tape can be made with the Carson Tape Splicer ®, which can be attached right to the recorder. It consists of a metal form with grooves that serve as razor guides. The tape ends are simply clipped to the tool, slightly overlapping (photo 1), and then razored to a close, clean fit (photo 2). Taping (photo 3) completes the job. Guides along the edges permit easy trimming of the adhesive. Made by Magnecessories, Washington, D. C., the splicer sells for $2.





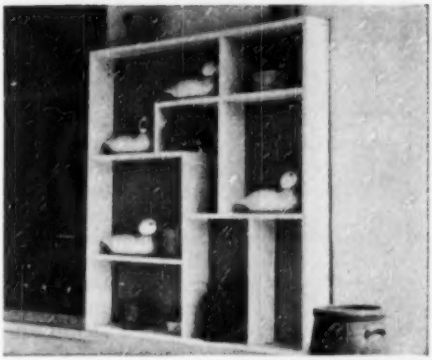
# Use a Towel Rack

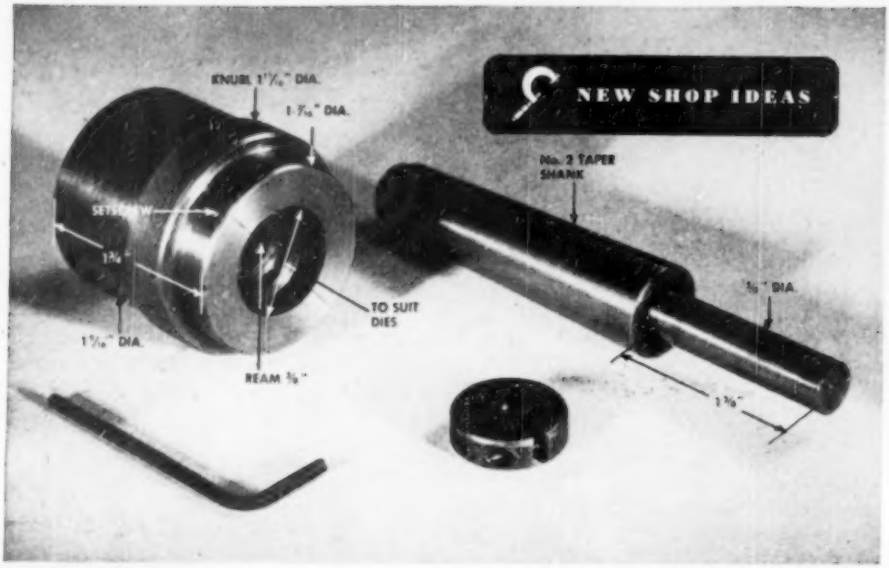
You'll find many spots where you can put towel racks to work. One over a workbench holds catalogs, magazines, plans, flat or round plastic, or dowels. Ceiling storage also handles table leaves, and a rake and hoe could be stored like the broom.

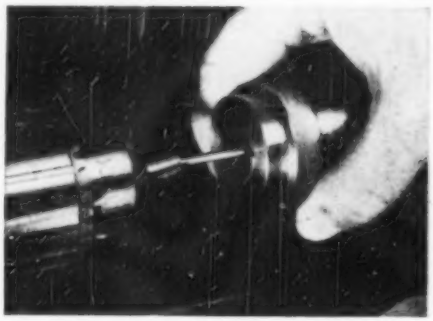
## Put Your Walls to Work

Whether on a porch or in the house, shelves like those at right make good use of bare wall areas. They are built of stock lumber with nailed butt joints. A ¾" plywood back serves as a brace for the shelves.

You can hang them with screws through the back or you can use shelf brackets underneath with one or two screws through the back near the top to steady the shelves. Before you cut up your lumber, make a scale drawing. Then the compartments will be the right size to handle the objects you want to put in them.—*Hi Sibley, Nuevo, Calif.*



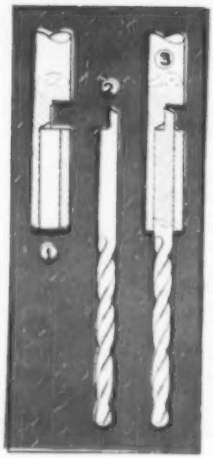


**Dies Held Square.** For threading work in the lathe, a die is often held against a drill pad while the spindle is turned by hand. Since the rotating parts have a considerable mass, it's hard to tell by feel how the die is cutting or how fast to advance it, so threads are often damaged or not started square.

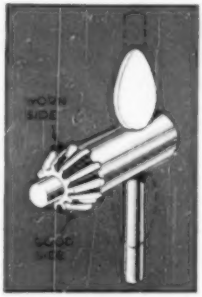
This tailstock die holder gets them square and leaves the die free to follow the thread. To make it, turn the outside of a piece of 1¾" cold-rolled steel, knurl, face, and drill through the ⅜" pilot hole. Bore the die seat to a push fit, using a fully expanded die as a plug gauge. Reverse to face the other end.

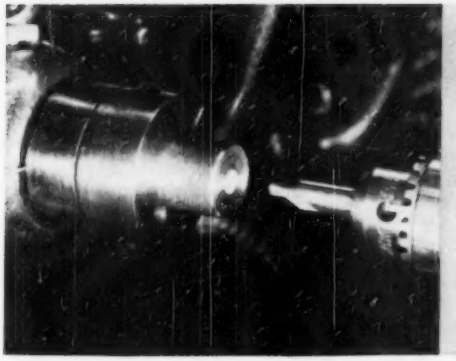
Insert a long taper shank in the spindle and turn the pilot a sliding fit in the holder. In use, clamp the tailstock and advance the wheel only to start the die. Then simply turn the holder by hand.—*J. Tracy, New York City.*

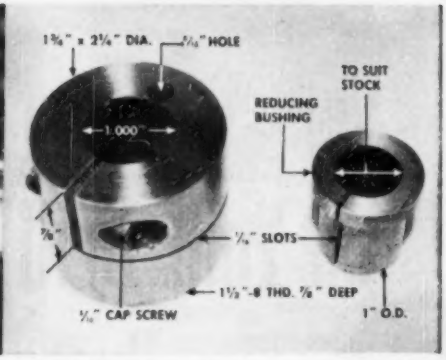



**Depth Drill.** If you must counterbore a deep hole and the drill won't reach, it can be extended in this way. Drill a piece of round stock with the drill you intend to use for the counterboring. File a slot half through the round stock right at the bottom of this hole (1). Then file down the drill shank (2) to fit the shoulder in the extension (3), and the rig is all ready to go.—*M. L. Dodge, Seattle, Wash.*

**Life of Chuck Key Doubled.** If the teeth on a drill-chuck key become worn, allowing it to slip, the key can be given new life by driving out the handle and driving it in through the opposite side of the hole.—*R. Rutledge, Sr., Kansas City, Mo.*



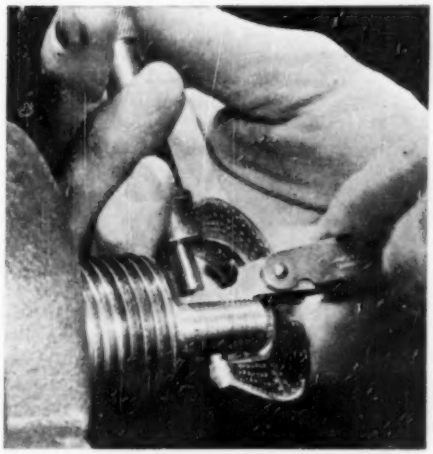




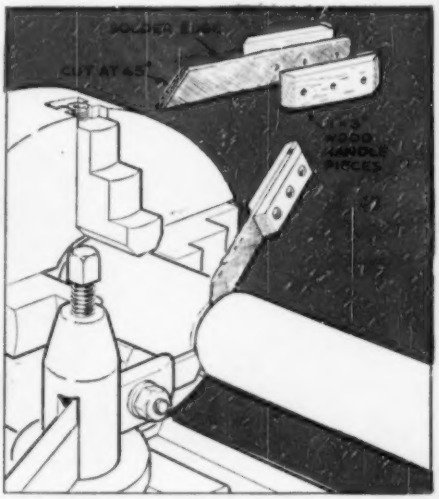

**Low-Cost Collet Chuck.** If fitted with a variety of collets, a pot chuck like this will center round stock of different sizes quickly and accurately.

Bore a 1¾" piece of 2½" rod half its length and thread to fit the lathe spindle. Then bore the stock opening through, about .010" undersize. Drill a 5/16" hole 1" deep and saw or mill a slot ⅞" long directly opposite. At right angles to this slot, cut another halfway through the diameter. This forms the closing spring jaw.

Drill a hole across the slot, open out half to 5/16", and tap the other side for a 5/16" cap screw. Tighten up the jaw with the screw before boring or reaming the stock opening to finished size.—*Wesley O. Walker, Montebello, Calif.*



**Checking Pitch Diameter.** Instead of taking work from the lathe to check thread fit, you can measure pitch diameter within a few thousandths with a screw-pitch gauge and a micrometer. Find the pitch diameter of the thread in a table and mike the width of the gauge leaf. Add, and check the total against the over-all measurement over gauge and thread, made as shown in the photo. This gives the same result as deducting single-thread depth from the major diameter.—*R. J. Lemp, Woodhaven, N. Y.*




**Oiling Cut-Off Operations.** A "knife" made from a piece of fine screen or wire mesh will put an even supply of oil at the bottom of the cut. Fold the screening upon itself, pound flat, and solder the edge. Trim one end to a 45° angle. Sandwich the other end between two pieces of wood. To use, dip into oil and apply inside the cut as the work turns.—*A. R. Christensen, Lockport, N. Y.*

# Spot-Welding on Your Drill Press

*By J. B. Posner*

**You can throw away your rivets, and join sheet metal with a welding outfit assembled from surplus items.**

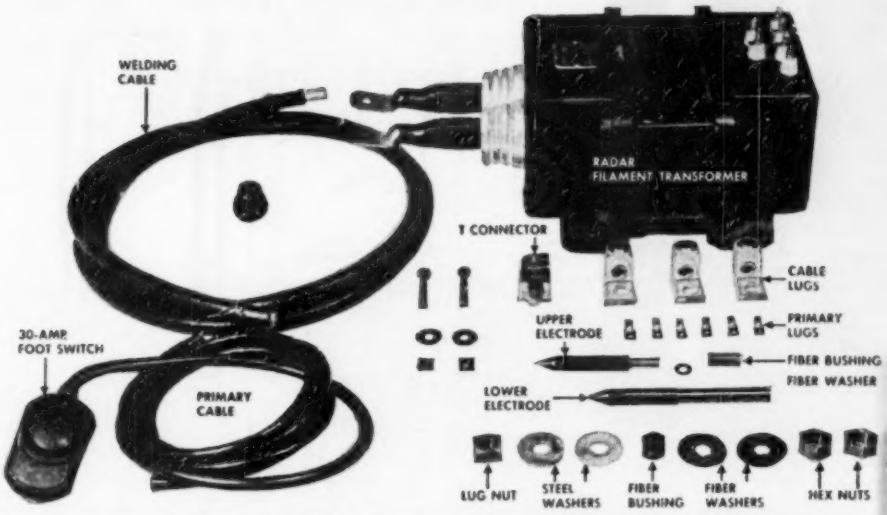
BY EQUIPPING your shop for spot-welding, you can seam together two pieces of sheet metal as easily as your wife sews cloth. Made as shown here, the outfit costs very little. Materials are available in radio-parts and electrical shops as war surplus.

A good transformer is the most important item. The continuous-rating filament type that powered ground radar sets during the war will serve well. These deliver 5 volts at 190 amp. and cost between $15 and $20. However, any transformer that delivers 2½ to 5 volts at 175 to 300 amp. will do.

Spot-welding requires a means of adjusting electrode pressure on the metal. That's why I use a drill press. It's ready-made for the job.

***Preparing the cables.*** You'll need two 24″ lengths of welding cable. Strip the insulation back about 1″ on all ends, using a sharp knife. Be careful not to nick any

**Mounted in the chuck,** the top electrode can be raised or lowered at will to vary pressure on the work.




**These are the parts I use, but substitutions are often possible. Foot switch is convenient.**

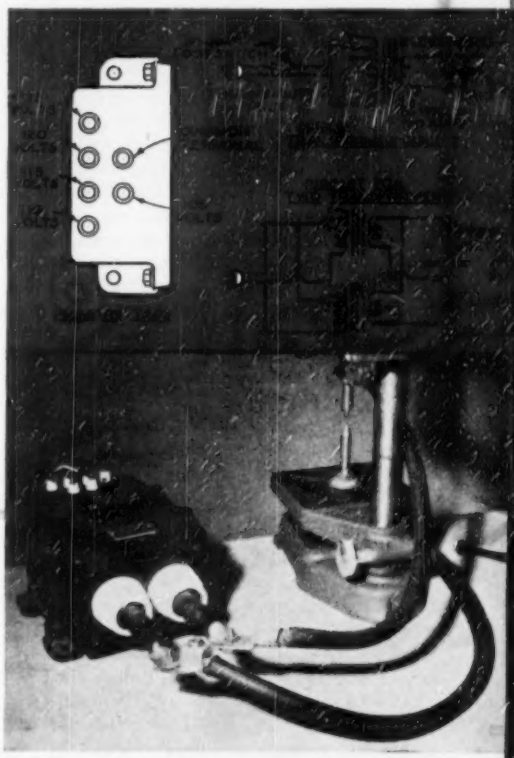
strands, or the cable may break when repeatedly flexed. Clean the exposed copper with fine sandpaper.

Attach lugs to three of the four ends. Place each lug in a vise, cup upright, and half fill the cup with plain or rosin-core solder. (Never use acid-core solder on electrical work.) Coat the cable copper with a noncorrosive flux, such as a small piece of rosin dissolved in alcohol. Heat the lug cup with a torch until the solder is molten, push the fluxed cable into it, and hold in position until the solder has hardened. Slide a T connector over the fourth cable end and tighten the setscrews firmly.

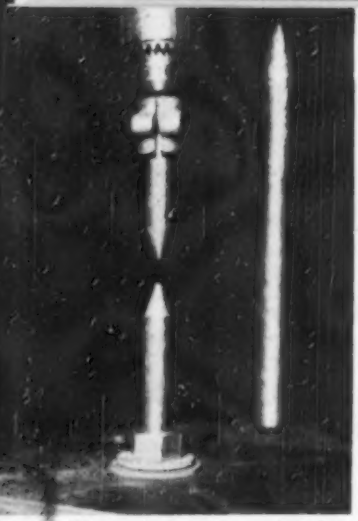
***Making the electrodes.*** Use hard-drawn copper or any copper alloy made especially for the purpose. The smallest permissible is ⅜" rod. Machine the tips to 1/16"-diameter points. Turn down the butt of the upper electrode and thread the butt of the lower one as shown in the drawing on the next page.

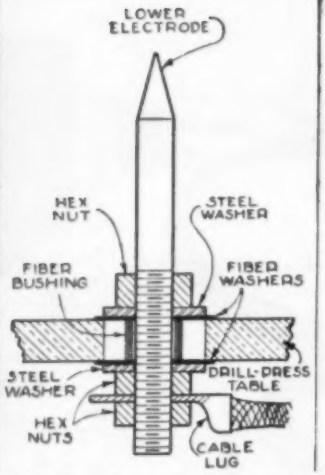
Insert the upper electrode into the T connector and tighten the setscrews. Over the small end of the electrode slide an insulating fiber washer and then a bushing. You mount this electrode exactly as you would a drill. Just tighten the chuck jaws over the bushing.

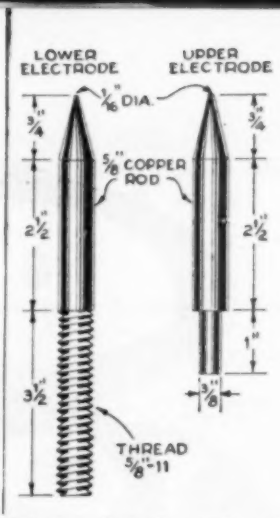
***Mounting lower electrode.*** This goes through the center hole on the drill-press table. First run a hex nut to the end of the thread and slip on a steel washer, fiber washer, and a fiber bushing in that order. Set the electrode in place and slip on ▶



**Welding cables** 24" long connect transformer and electrodes. It's a good idea to tape the connecting lugs to forestall shorts. Above are wiring diagrams for single and double transformer. Latter is needed for heavy-duty work.






**Electrode tips** are machined to 1/16"-diameter points. Fiber bushings and washers insulate electrodes. Tips of the two electrodes must meet squarely in alignment for proper operation.

a fiber washer, steel washer, and a nut. Make the assembly just fingertight.

Next bring down the upper electrode and align the lower one so the two points make square, full contact. When this has been done, tighten the lower-electrode assembly, put the cable lug on the portion projecting under the table, and turn up the final nut.

***Hooking up the transformer.*** Now connect the free ends of both cables to the transformer, using bolts, nuts, and washers. Tape these connections to prevent shorts from metal or tools that may accidentally drop across the terminals. Finally, make certain all connections are tight on the primary cable. Taking such pains with connections may seem unnecessary if you have never worked with high-amperage juice—but it's vital to proper operation.

With all connections checked over, you're now ready to go.

***How the outfit works.*** In spot-welding, the two electrodes pass a heavy current through the adjoining pieces of sheet metal. Because the metals at this point impose a high resistance, compared to that of the lead lines and electrodes, intense heat develops. This melts the metals and they fuse together.

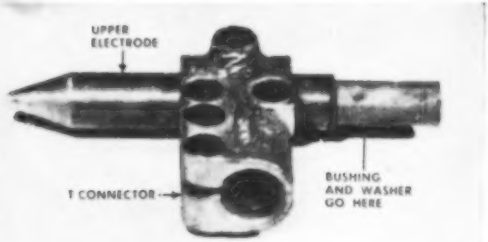
Spot-welding works best with ordinary carbon steels and stainless steels. Other metals require extremely accurate heat control. For example, the temperature range at which aluminum remains usably molten is very narrow. If you don't apply enough heat, you won't get a weld. If you apply too much, the metal will vaporize, leaving a hole.

***Tips on welding.*** To familiarize yourself with the technique, get several scraps of 20- or 22-gauge cold-rolled steel. Clean in a hot solution of Oakite® or similar degreasing agent. Dry thoroughly.

Place the strips, with about 1" overlap, on the lower electrode and bring down the upper one with light pressure. It's best to wear a glove when handling short pieces.

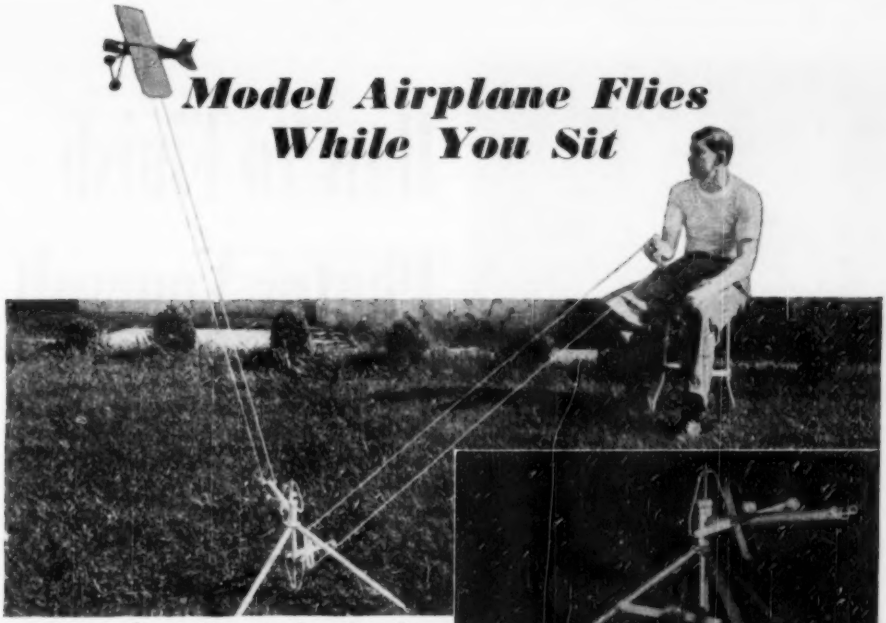
Close the switch and increase the electrode pressure slightly. Metal around the electrodes should glow red immediately. If the redness is slow in appearing, decrease the pressure slightly. After the red spot appears, increase the pressure slightly. Then shut off the power. But hold the sheets in position for several seconds before releasing the pressure. This allows the metal to set.

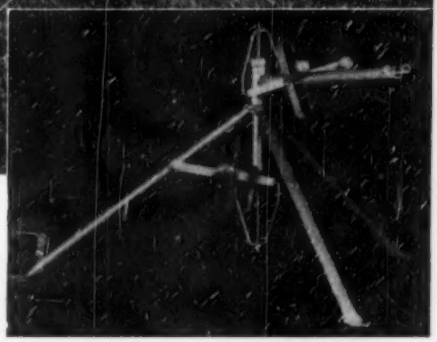
Repeat spotting until a seam is complete across the strip. Then just try to pull the pieces apart. If the weld is good, the metal itself may tear, but the seam never will. END




**Mount top electrode** in T connector. Place the latter ¼" to ½" below the shoulder of the electrode. Connector clamps over end of cable.

# Model Airplane Flies While You Sit





By using the De-Dizzer®, the pilot of a cable-controlled model plane doesn't have to stand up and turn around and around as he guides the ship. The plane can be controlled from a comfortable sitting position.

The plane is attached to the rotating arm by the usual two control wires. Two other wires run from the stand to the operator's control handle. Movements are transmitted through the vertical push rod around which the upper arm travels. Stakes anchor the legs down. The Jarvis Battery & Electric Co., Winston-Salem, N. C., is the maker.

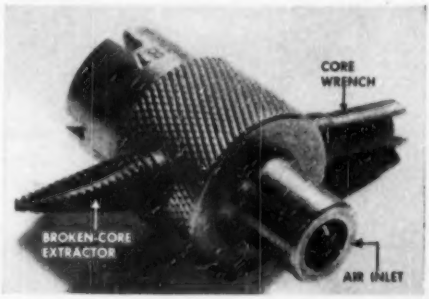
## Toy Roof Looks Like Tile

Corrugated cardboard can be used to simulate a tile roof on a toy house. Cut it to the size desired and paint it a bright red or orange for realism. The cardboard can also be used to represent corrugated iron.—*J. G. Bindas, Arnold, Pa.*

## Dogs Are Going to the World

Racing greyhounds ride from track to track in style in this de luxe trailer, built by Walter Knight, of St. Petersburg, Fla. Venetian blinds, screens in the windows, electric brakes, drinking-water tanks, an ice box to store the meat supply, and adjustable overhead air vents are features of the trailer. The brakes are designed to go on automatically if the trailer should break away from the tow car.

## Valve Tool Has Air Inlet




Besides keeping a tire valve from slipping back into the casing, this valve holder makes it possible to inflate the tube without removing the tool. All you need do is apply the hose to the air inlet. Rinck-McIlwaine, Inc., of New York City, prices it at 40 cents. The tool can be obtained either with a broken-core extractor, as seen here, or with an inside rethreader.

# How to Finish Photos Yourself for 55 Cents

***By George S. Cowlam***

This is what you need to develop and print a roll of film. Soup plates make trays; glass, cardboard, and clothespins, a printing frame; red cellophane, a safelight. Thermometer helps check developer temperature, but you can do without it. Chemicals, paper are what cost 55¢.

**You don't need a lab full of fancy equipment to develop and print your film—just a kitchen.**

SAYS you: "I'd like to make my own pictures, but it costs too much to buy the equipment, and it's too technical, and besides, I haven't the time."

Says we: Are you through work for the day, must you go to bed before 10 p.m., and can you get up 55 cents?

If the respective answers are yeah, no, and here it is, let's do a little shopping, and before you hit the hay, you'll have your first print—the picture that will be all yours, from the click of the shutter to the final trimming job with the family scissors.

The 55 cents goes for chemicals and printing paper, on sale at any photographic store. You need *universal developer* and *fixer* (Eastman Kodak makes a Tri-Chem Pack® that includes both of these plus a short-stop rinse for about 20 cents). Buy *glossy, grade 2 (normal contrast)* paper to fit your film—25 sheets of the size for 120 or 620 negatives cost about 35 cents.

The rest of the stuff is almost sure to be around the house—and we don't mean spare parts from a 1922 Cadillac, either. What you do need are: three ordinary soup plates, a drinking glass to measure liquids, a wood stick for stirring, a small piece of glass (take it out of a picture frame or cut from window-glass scrap), very stiff cardboard (we cut ours from a cigar-box lid), a thermometer, a few spring clothespins, string, scissors, some dark-red cellophane or gift paper, a towel.

Of course, you must also have an exposed but undeveloped roll of film. It's best to learn with ortho film (Verichrome® or Plenachrome®), since the panchromatic types must be developed in total darkness. Naturally, this setup isn't intended for the "serious" amateur. But for the guy who wants to try out photography, or who wants to process a few rolls once in a while, it will work perfectly well.

Your darkroom is the kitchen. Protect the drainboard with newspapers and lay out your soup plates. Mix the chemicals in them according to the instructions in the package. The developer goes in the left-hand plate, the short stop (or plain water) in the middle, and the fixer in the right-hand plate.

Put a small bulb in the kitchen fixture and wrap it with the red cellophane—that's your safelight. It should be so dim you can just barely read the clock or watch. Don't worry about bits of light coming through cracks around the door so long as none shines right on your film.

1 **Hold film by clothespins** and seesaw it through developer, moving arms up and down, for time recommended—go by the clock, not appearance of negatives. Then seesaw in rinse a few times, and in fixer for twice time needed to remove milky color (10 minutes).

2 **After fixing,** wash the film in running cold water for about 20 minutes. If your sink doesn't have a stopper, put the film in a pot and let the faucet run into that. Leave the clothespins on—they'll keep the film from curling up into a spiral and also make it easier to handle.

Now you're ready to warn the family not to burst into the kitchen for a glass of water. Unroll your film just enough so that you can clip a clothespin on the end. Now unroll it the rest of the way, tear the other end from the paper, and put a clothespin on that end. Hold the film by the clothespins and keep it stretched out taut. It curls up while dry.

Okay? You've got an armload of film. Now just do what's shown in the pictures on these pages and you'll soon have finished prints to show off.

3 **The string,** threaded through the clothespin springs, holds the film while it dries. Wipe some of the water off with your wet fingers, as shown above. Don't squeeze hard—emulsion scratches easily when wet. It'll be dry in about 45 minutes, unless the weather is very muggy.

4 **Your printing frame** is made of the cardboard and glass. Take out *one* sheet of printing paper, lay it glossy side up on the cardboard, then lay the negative glossy side up on top. Slide the glass over, fasten with clothespins. Brighter room light is safe to use when printing.

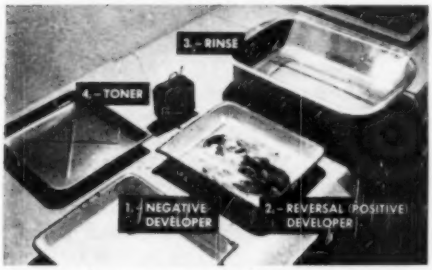
5 **A table or desk lamp** makes a convenient printing light. Hold the glass side of the printing frame a foot or so from the bulb—but the same distance every time—and turn the light on for five seconds (count "one thousand, two thousand, . . ." to measure seconds).

6 **Swish the paper around** in the developer for the recommended time. Rinse a few seconds, then let it stay in fixer for 15 minutes while you print and develop others. Finally wash in running cold water for *one hour.* If prints are too light or too dark, change exposure time.

7 **The easiest way** to dry prints is to lay them face down on a towel. And soon you'll have the pictures you made yourself from start to finish. Don't worry about doing all this with ultra-scientific precision—a little bit one way or another won't make very much difference.

# Negatives Go Down Drain In New Printing Process

**Paper is exposed** by enlarging or contact. In first steps, you use a common safelight. Here, 35-mm. color slide is enlarged to 8" by 10".




**Two developers are used,** the first any common paper developer. The negative forms in this. A minute is about right. Then the sheet goes into the reversal bath, as seen above. There it's left, without agitation, for three minutes while the positive image develops in the second coating. After it has been in this bath 30 seconds, you can turn on the white light.

A NEW photo paper coated with two emulsions offers photographers a quick way of making sepia or other single-tone prints from color transparencies. A negative image forms on the top emulsion, a positive on the lower. After the negative layer has done its job, you simply wash it away.

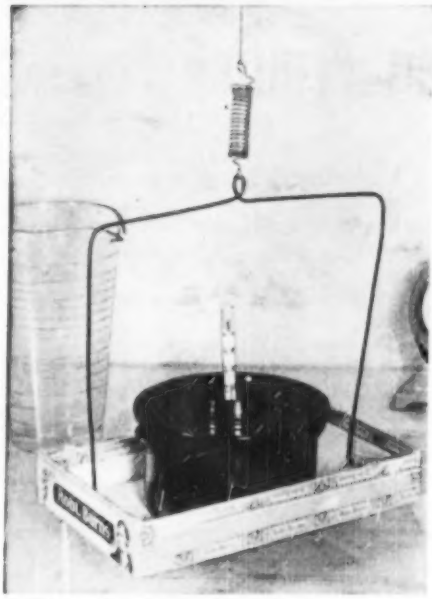
Developed in Belgium by the Gevaert Company, the new paper works by what the company calls reversal-transfer by diffusion. This means that after a negative image has formed in the top coating, the undeveloped silver salts in this layer diffuse downward into the second. There the salts are changed into metallic silver, creating the positive image. The accompanying photos show how the paper is used in making prints from transparencies of any size.

Called Diaversal®, the paper is distributed in the United States by the Gevaert Company of America, Inc., of New York City. This company also supplies chemicals required for making the reversal solution.

**Next the negative washes away,** and you begin to see the positive image. This bath is simply plain water. Rested on a sheet of glass for easier handling, the wet print is stroked with a wet pad of cotton. As the negative coating peels off, you notice that the positive image is a weak yellowish color. Toner will cure this.

**Toner strengthens image.** In this case, a selenium toner was used, the image deepening to a pleasing sepia. Other toners would produce different tones. After being toned for about three minutes, the print is washed for five or 10, and then dried. Like other reversal processes, this one gives a black border.

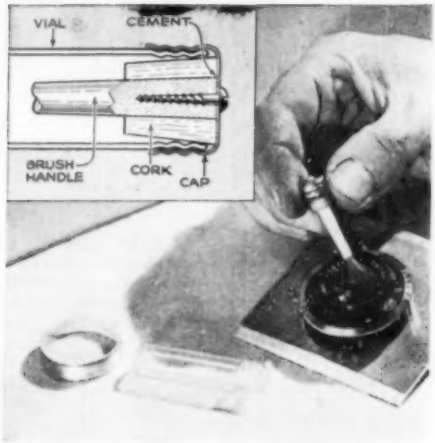
## PHOTO IDEAS AND EQUIPMENT



**Spring Agitates Tank.** A cigar box, wire coat hanger, 48 inches of string, and a spring combine to form an excellent film-tank agitator. Given a good twist, the one shown spins and jounces for 15 minutes. *—J. M. Overstreet, Birkenfeld, Germany.*

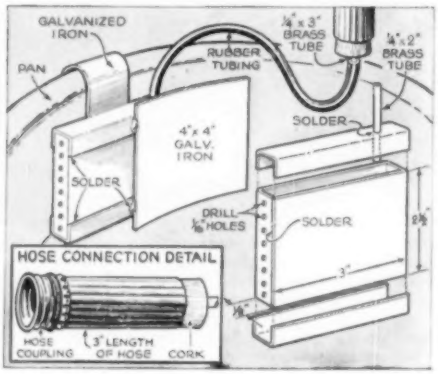
**Disk Speeds Up Filtering.** Ordinary absorbent cotton is an efficient and inexpensive material for filtering photo solutions, but it tends to pack down in the funnel. To hold it back, cut a disk of ⅛" plastic, drill several holes in it, and cement the disk inside a one-pint funnel.—*F. T. Sokolik, Chicago.*

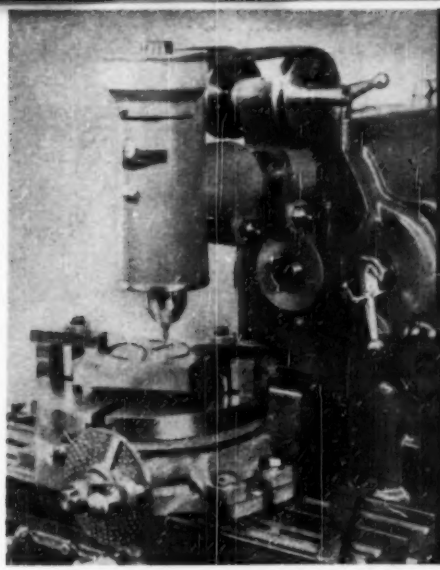
**Clothespin Holds Thermometer.** Tape a spring clothespin to your photographic thermometer. The unit can then be clipped to the edge of a solution tray. *—R. K. Wahler, Fond du Lac, Wis.*

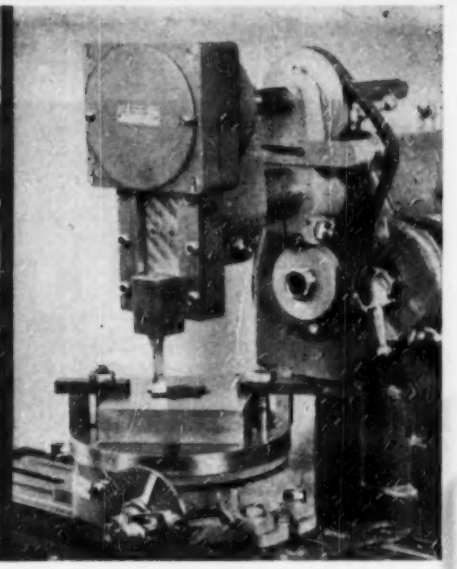



**Making a Lens Brush.** A small round artist's brush, an empty dental-floss vial, a small cork, and some cement make an excellent lens brush with its own dust-proof case. Total cost: ten cents. Cut the brush handle so the bristles don't quite touch the vial bottom and cement it into a hole in the cork. This in turn is cemented and screwed to the underside of the cap.

**Washer Keeps Prints Moving.** A print washer that does a thorough job is shown below. Form the parts of the metal box around a wood block cut to the proper size. Solder all joints, making them water-tight. Drill 1/16" holes in one end and a ¼" hole on top for the 2" length of brass tubing that takes the rubber tubing. Bend the 4" by 4" deflecting plate and the hook to fit the pan. A hose coupling, stub piece of hose, and a cork attach the washer to the faucet.—*J. A. Appelquest, Leonia, N. J.*





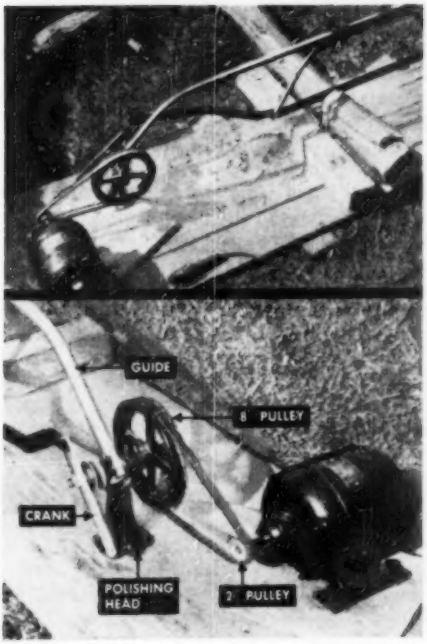


## Attachments for Bench Mills

BENCH mills can be used for more jobs with these new attachments. The vertical head (at left) for a horizontal mill can be set at any angle or pulled out past the table for overhanging work.

A slotting attachment, right, allows the mill to do the work of a small shaper. Its stroke is adjustable from 0 to 2". Both attachments take their power from the machine arbor. A rotary dividing table, a third accessory, is shown in both photos. Marvin Machine Products, Detroit, makes them to fit Atlas millers, but they can be adapted to work on others.

# Standard Parts Motorize a "Quickie" Bow Saw



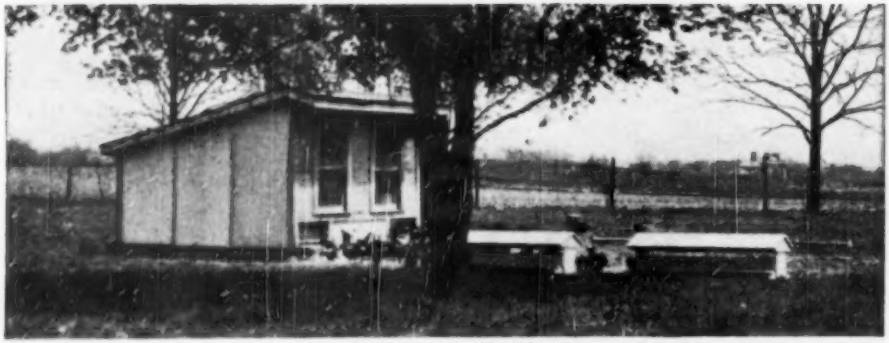

DETERMINED to avoid sawing a pile of logs by hand, I quickly rigged a drag saw by combining my bow saw, a 1/6-hp. motor, and a polishing head in the setup pictured.

A piece of pipe serves as a guide. The saw, mounted on two bent metal clips, slides back and forth on the pipe. One end of the guide pivots on the shaft of the polishing head. The crank is a length of strap iron clamped on the shaft. Another piece of strap stock forms the connecting rod.

Sitting at one end, I operate the switch, push down the saw guide, and hold the log against the stop.—*E. Herzog, Bethlehem, Pa.*

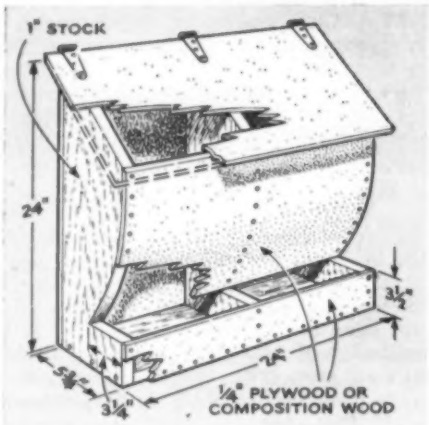
## Replacing Teeth in Zippers

SLIDE fasteners that have one or two teeth missing can often be repaired with teeth salvaged from discarded garments. Remove these from the discarded fastener by pulling them firmly with tweezers. Pry open the prongs that grip the cloth, put the tooth in place of the missing one, and press the teeth together. Zipper teeth vary in size, so it's important to select replacements that match. —*Katherine Binder, London, Ont., Canada.*



**Outdoor feeders** need a rainproof cover. The two above will hold enough feed for 200 or 250 pullets for four or five days. Construction details are shown in photo at bottom of page.

# Poultry Feeders That You Can Build




**Grit and oyster shell** are a requirement for laying hens. This hopper-type feeder will keep your flock supplied for a long period.

**Cover swings up** for easy filling. Trough is 3½" deep, 11" wide, and 6' long. Two-by-fours raise this feeder to right height for turkeys.

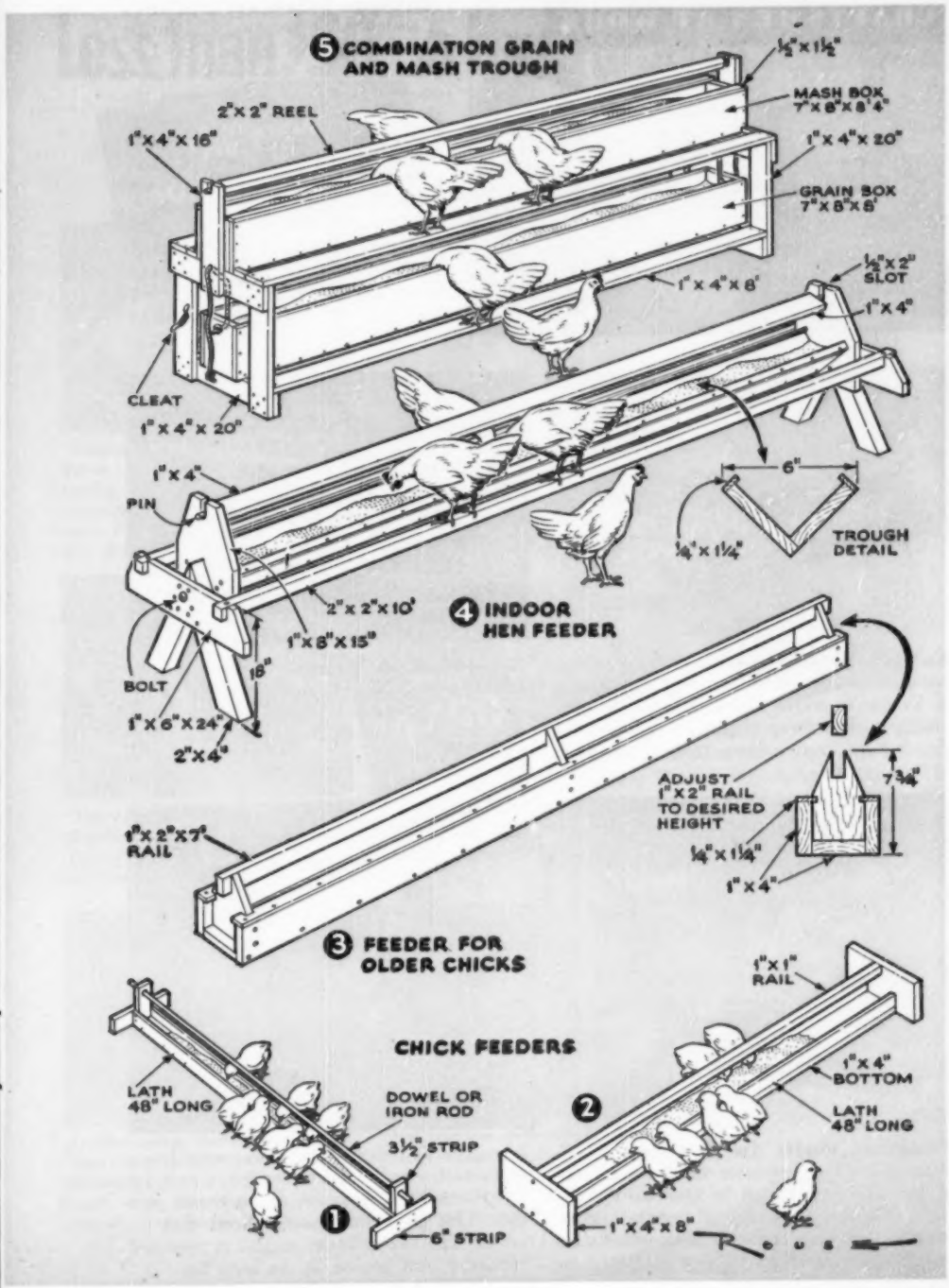
BESIDES lightening your chores, these easily built poultry feeders will increase your profits. They reduce feed losses, keep the feed clean, and—by letting the birds eat as much as they want when they want it—cause the chicks to grow faster and the hens to lay more eggs.

Guard rails, or reels, are fitted to all the indoor feeders on the opposite page for two reasons. The rails allow the birds ready access to the feed, but keep them out of the trough. This prevents feed from being wasted and keeps it cleaner. The larger feeders also have feed-saving strips along the edges of the trough.

Capable of being knocked together in only a few minutes, the lath feeder (Fig. 1) will feed about 100 baby chicks during their first two weeks of life. From then until the three-month stage, the wider version (Fig. 2) will take care of about 50. As a final step, the larger feeder (Fig. 3) will carry the chicks through to maturity. As the chicks grow, you can gradually raise the height of the rail of this feeder.

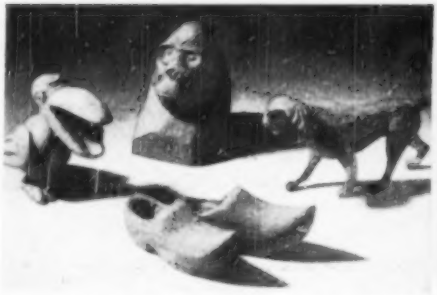
For each 100 laying hens, provide three of the mash feeders shown in Fig. 4. It's a good idea to supply fresh feed in such feeders each day, for this tends to stimulate consumption and increase egg production.

The combination grain and mash trough (Fig. 5) has the advantage of occupying a minimum of floor space. If grain is not to be fed, the lower box can be raised against the bottom of the upper one and held by looping the ropes around the cleats.

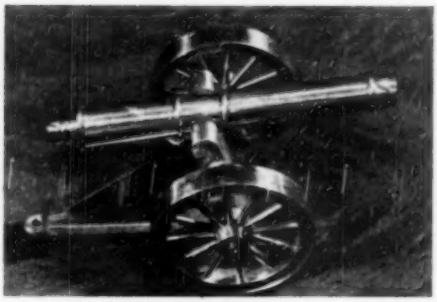

5 COMBINATION GRAIN AND MASH TROUGH
½"x1½"
MASH BOX 7"x8"x8'4"
2"x 2" REEL
1"x4"x 16"
1"x 4"x 20"
GRAIN BOX 7"x8"x8'
1"x 4"x 8'
½"x 2" SLOT
1"x 4"
CLEAT
1"x 4"x 20"
1"x 4"
PIN
6"
¼"x 1¼"
TROUGH DETAIL
2"x 2"x 10'
4 INDOOR HEN FEEDER
1"x 8"x 15"
18"
BOLT
1"x 6"x 24"
2"x 4"
ADJUST 1"x 2" RAIL TO DESIRED HEIGHT
7¾"
1"x 2"x 7' RAIL
¼"x 1¼"
1"x 4"
3 FEEDER FOR OLDER CHICKS
1"x 1" RAIL
CHICK FEEDERS
1"x 4" BOTTOM
LATH 48" LONG
DOWEL OR IRON ROD
2
LATH 48" LONG
3½" STRIP
1
6" STRIP
1"x 4"x 8"

## CRAFTSMEN AT WORK

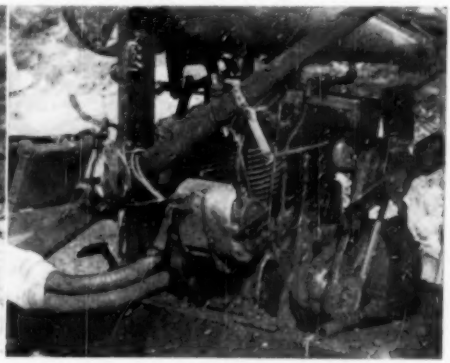
**Antique Flies on Tether.** A scaled-down version of a Curtiss biplane flown in 1914-15 by Lincoln Beachey, this model has a one-cylinder engine that whips the ship up to 55 m.p.h. on a control line. For flying, the center of balance was moved forward by casting the body of the pilot of lead from the waist down. The pilot's backbone is a coil spring; this permits side-to-side and forward-and-back movement when the elevator controls are worked. Ted Morrison, Oakland, Calif., built it.



**Carves Knickknacks.** As a hobby, Leonard Cronk, a cabinetmaker in Valhalla, N. Y., carves oddities like those above. The dog and shoes were cut from white pine, the monkey and pelican from applewood.



**Modeled in Brass.** This neat scale model of a Civil War artillery piece is the work of Kenneth E. Maurer, of Flint, Mich. He worked from POPULAR SCIENCE plans (Jan. '47, p. 152).



**Tractor Built in Cellar.** L. C. Warner built this tractor in the basement of an apartment house in Queens Village, N. Y. The frame was bolted together rather than welded so it could be dismantled. He then hauled the parts in his car to his new home site 75 miles away. The tractor has a motorcycle engine and transmission coupled to a DeSoto transmission and a Saxon rear end. This gives nine speeds ahead, four reverse. The two-cylinder engine is mounted crosswise and cooled by an auto fan.

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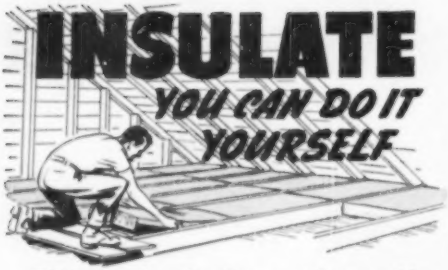
**Stows away in its own suit-case-type packing case**—ideal for closet storage.

Kodak

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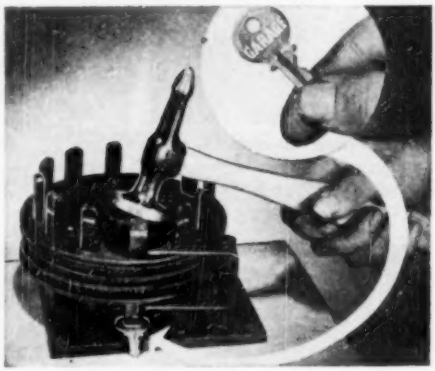
**Div. Savage Arms Corporation, Chicopee Falls, Mass.**

## Kit Keeps Thread Tanglefree

THE kit shown above keeps the family sewing box free from the tangle of unwound thread. Its six spools, clearly visible through the package's transparent side wall, feed thread out through portholes as needed, while the kit keeps its contents dustproof. Clear Pak Inc., of Brooklyn, N. Y., makes the kit, which also holds needles.



## Dies Identify Keys

You won't have to fumble for the right key if it's identified by the device above. Mounted on a metal base, Ident-A-Key Set® consists of a six-inch steel turntable that holds 12 steel marking dies. To imprint a key, the proper die is placed over the key handle and struck with a hammer. Red pencil or white paint can then be rubbed into the letters to make them more legible. Metro Mfg. Co., Chicago, makes it.

• Brawny power under finger-tip control . . . new maneuverability, operating convenience, handling ease . . . sharply advanced performance that brings new thrills to boating . . . *with these sparkling new models Evinrude again makes outboard history!*

**FLEETWIN WITH DUO-CLUTCH:** *You start* the motor in *Neutral* . . . "idle" whenever you like, at dock or fishing spot . . . press the control button and you're in *Forward*. Full Pivot Reverse and 360° steering for complete maneuverability. Safti-Grip Propeller Drive for trouble-free operation in shoal water. 7.5 certified horsepower* . . . *low trolling speed* . . . and exhilarating top throttle performance that "brings out the best" in typical family and fishing boats!

**FASTWIN WITH GEARSHIFT:** 14 horsepower* for thrilling speeds, heavy loads . . . with *Gearshift* that lets you reverse, idle and maneuver with motor car ease of control! And to give you broad cruising range the Fastwin comes with separate 6-gallon *Cruis-a-Day Tank*. You stow the tank anywhere in the boat . . . and "hook-up" the fuel line to the motor as easily as plugging in a lamp socket!

**SEE YOUR EVINRUDE DEALER:** He will gladly show you the complete line of Evinrude models for 1950 . . . the 1.5 H.P.* *Sportsman* and 3.3 H.P.* *Sportwin*, both with exclusive FISHERMAN DRIVE that "let's you go anywhere there's water to float your boat." For largest, fastest boats, the 22.5 H.P.* *Speeditwin* and the 33.4 H.P. four-cylinder *Speeditwin*. Look for your dealer's name under "Outboard Motors" in the yellow pages of your phone directory.

**CATALOG FREE!** Write today for full-color catalog of the 1950 Evinrude line.
EVINRUDE MOTORS,
4405 N. 27th Street,
Milwaukee 9, Wis.

*In Canada:*
*Evinrude Motors,*
*Peterboro, Ontario*

**EVINRUDE**
**FIRST IN OUTBOARDS . . . 41st YEAR**

Make $20 to $30 a Week

# EXTRA MONEY

## MACHINE SAW FILING PAYS UP to $2 or $3 an HOUR

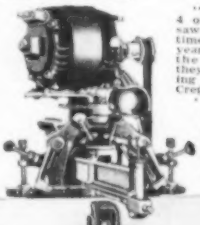
• Turn your spare time into CASH—sharpening saws with a Foley Automatic Saw Filer pays up to $2 or $3 an hour. You will find you can make $20 to $30 a week in your spare time as a starter.

You can work in your basement or garage—no experience necessary. "The first saw I sharpened with my Foley Filer came out 100%"—writes Clarence E. Parsons. No canvassing—"I advertised in our local paper and got in 93 saws"—says M. L. Thompson. The Foley is the only machine with which you can file all hand saws, also band saws and cross-cut circular saws.

## SEND FOR FREE BOOK "INDEPENDENCE AFTER 40"!

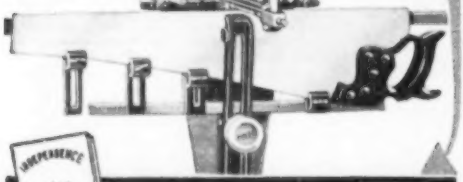
Shows how you can get business from home owners, farmers, carpenters, schools, factories, etc. With a small investment, no overhead, no stock of goods to carry, you can get right into a cash business.—and possibly later on develop into a full-time repair shop. Send coupon today for Free Book.

"Each saw I filed got me six more and business has been picking up that way since a year ago. If it keeps up I will have to buy another Foley Saw Filer." William C. Baldwin



"I have done 4 or 5 thousand saws in my spare time in the 4½ years since I got the outfit, and they are all coming back." Len Crego

"Have filed over 2200 saws in 18 months. One customer always brings another." E. A. Fink



SEND COUPON FOR FREE BOOK

FOLEY MFG. CO., 219-O Foley Bldg.
Minneapolis 18, Minnesota

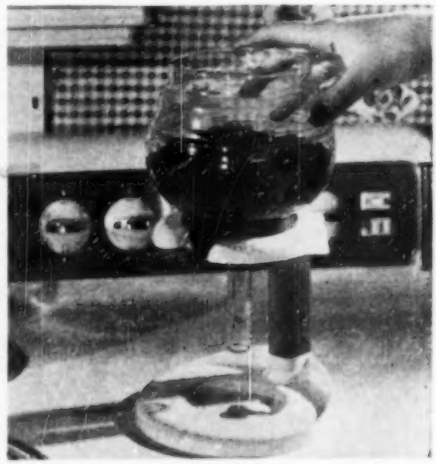
Send FREE BOOK—
"Independence After 40."

Name.....

Address.....

### Extension "Legs" Raise Table

An ordinary folding card table can be raised to the level of the dining-room table, for use as an extension when you have more guests than room to seat them, by fitting its legs with tubes having hardwood plugs. Add-A-Foot® comes in one-inch- and 1⅜-inch-dia. sizes. A set of tubes, made by Syland, of Staten Island, N. Y., sells for $1.



### Holder Protects Coffee Maker

This Bakelite® holder offers a safe place to put the top of the coffee maker when you have finished making the morning brew. It also catches the drops that run off the grounds. The protector is made by Wolverine Plastics, Inc., of Milan, Michigan.

# The one fine car in the low-price field

# '50 FORD

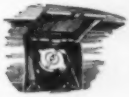
## 50 WAYS NEW

**Take a GOOD look—**
**Take a GOOD ride**

**AT YOUR FORD DEALER'S**

***NEW*** box-type frame rails have steel of greater thickness for increased rigidity. Five rugged cross members give torsional strength.

***NEW*** shields on front brakes plus labyrinth seals between backing plate and drum on all wheels protect brakes from dirt and water.



***NEW*** gas filler tube and cover . . . *new* non-spill vent tube that allows air to escape freely. Closed cover blends into body.

***NEW*** one-piece torsional stabilizer, rubber mounted on lower control arms, and improved front suspension add to Ford's famous roadability.

***NEW*** front end styling . . . *new* parking lights . . . *new* smart medallion . . . *new* "Air Foil" grille . . . *new* stronger bumper guards and bumper support arms.

**ENGINEERING ADVANCEMENTS MAKE**
**FORD'S 100 h. p. V-8**
**QUIET AS A WHISPER!**

***NEW*** permanent-type lubricant on hand brake shaft assures continued easy operation. Smart new hardware—inside and out—adds new beauty.

***NEW*** "Magic Air" heater control is clearly marked, compact, easy to operate and lighted for after-dark use. ("Magic Air" heater optional at extra cost.)

***NEW*** defroster openings are 44% wider and air flow is 25% greater for wider vision in bad weather . . . *new* interior light switch mounted on instrument panel saves groping in the dark.

***☆ Dozens of other BIG features!***

**There's a Ford in your future... with a future built in!**

Used and Endorsed by LEADING OUTDOORSMEN Everywhere!

Coleman

FLOODLIGHT LANTERN

* Prices as low as $9.95 in U. S. A.

"My Coleman Lantern adds more hours of fun, with plenty of good light in camp at night," says ANDY DEVINE, sportsman and picture star, and owner of Sportsmen's Tavern, Big Bear Lake.

'I wouldn't be without my Coleman. You need it for a brighter camp light and longer outings," says JOE GODFREY, founder of the Sportsman's Club.

"You need adequate light when you haul big ones aboard—that's why I use Coleman," says JOHN HIGHTOWER, noted outdoorsman.

Floodlights 100-ft. area—20 times as bright as wick-type lantern. Storm-proof. Safe. Ask your dealer.

GOOD EATS Quick...Anywhere

Cooks like a city gas range. Lights instantly. Folds up; carries like a suitcase. Safe.

Prices as low as $8.95 in U. S. A.

Coleman

Folding Camp Stove

The Coleman Company, Inc., Wichita 1, Kansas

The Coleman Company, Inc., Dept. 208-PS, Wichita 1, Kans.
Please send me FREE booklet, about Coleman Lanterns and Camp Stoves.

NAME.....

ADDRESS.....

CITY..... STATE.....


## Wax Eases Home-Movie Film

In warm, humid weather, movie film often sticks in the film-gate channel, causing torn sprocket holes and interrupted showings. This can be corrected by coating the film with paraffin. Such treatment also tends to delay drying out of the film—a condition that makes it brittle and easily damaged.

Clean the film thoroughly by winding it several times through a clean, soft cloth that you have saturated with carbon tetrachloride. Because of rapid evaporation, the carbon tet will disappear almost immediately.

Make your coating solution as follows: Pour about two tablespoons of carbon tet into a glass and shave into it ordinary paraffin wax, stirring with a match stick until the mixture reaches its saturation point. Then add enough carbon tet to triple the volume. The mixture must be fairly thin.

Apply it with a saturated cloth held in contact with one side of the moving film. Do this once to each side of the film. When the wax is dry, run the film through a dry cloth to wipe off any excess.

In splicing waxed film, carefully scrape joining surfaces.—*W. H. Hunter, Tunkhannock, Pa.*

## Glue Brush Made of Rattan

Rattan of about ⅜" diameter taken from discarded porch furniture can be made into excellent glue brushes. Cut it into pieces 10" or 12" long, and carefully scrape off any paint or varnish from 2" at one end. Boil these ends in water for an hour. Then hammer the softened ends on the end grain side of a wood block. For fine work, a single length can be used as a small brush. For bigger jobs, wire several together.—*E. N. Rizzotti, Mt. Vernon, N. Y.*


CHAMPION V-GLOW PLUGS

for model engines only

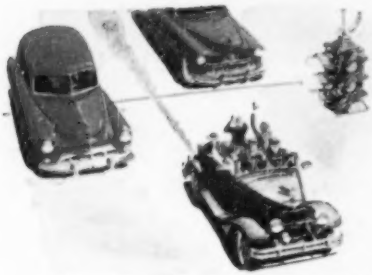
- CHAMPION TERMINAL—assures better center electrode seal and provides sturdier electrical connection.
- CHAMPION-CERAMIC INSULATORS—proved dependable in millions of Champion Spark Plugs.
- CHAMPION SILLMENT SEAL—prevents excessive compression leakage between insulator and shell.
- CHAMPION "THERM-O-FLEX" CONSTRUCTION—longer element life, more dependable performance.

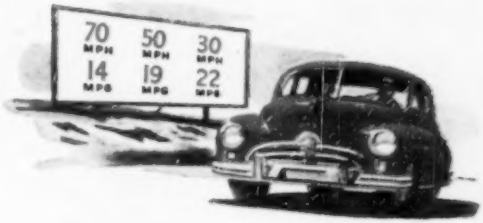
Follow recommendations of plug types and fuels approved by engine manufacturer.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, O.

# BE A CHAMPION DRIVER

## FOLLOW THESE RULES TO STRETCH GAS MILEAGE






Showoff acceleration proves nothing and is extremely wasteful of gas. Normally this type of driver has to slow down a moment later. Drive steadily—you will arrive at your destination **safe and sound.**

Gas mileage goes down drastically as speeds go up. Table above is based on actual tests of six-cylinder medium-priced cars. Make a habit of driving at conservative legal speeds **because it pays.**

Have your spark plugs tested, cleaned, adjusted regularly, replaced every 10,000 miles. One missing plug in a set of six wastes up to one-sixth of your gas—to say nothing of impairing starting, performance and dependability. You can rely on your Champion dealer **for dependable service.**

A *Champion* driver cultivates driving habits that will increase the pleasure, the performance and the economy of his car throughout its useful life. As one of the most important investments you have, it deserves the best in service and equipment. When you need spark plugs, follow the experts—race drivers, master mechanics, airline and fleet maintenance men, who insist on dependable Champion Spark Plugs . . .

***. . . BE A CHAMPION DRIVER—IT PAYS.***

***FOLLOW THE EXPERTS-*** *Demand*

Guy Lombardo, famous for "the sweetest music this side of Heaven" and equally noted as a motorboat racing champion says, *"I always use dependable Champion Spark Plugs to get the sweetest music out of my engines."*

AMERICA'S FAVORITE
**CHAMPION**
SPARK PLUGS

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

*Listen to the CHAMPION ROLL CALL . . . Harry Wismer's fast sportscast every Friday night, over the ABC network*

# Outboard News

*About the new Scott-Atwater Shift motors*

**WHY ROW?** With a Scott-Atwater *Shift* motor, you can start in Neutral, while still tied up at the dock. Then *Shift* to Reverse and back away like a cabin cruiser. The *Shift* is simple, sturdy, foolproof . . . adds little to motor weight!

**Our motors even turn on their own GAS**

All Scott-Atwater *Shift* models with conventional gas tank (1-14, 1-16, 1-20) have automatic gas line and air vent control. When you move the speed control lever to the "start" position, the gas is turned on, the vent opened. When you stop the motor, gas and vent are closed automatically. Never before have outboards been so simple to run.

WATER TAXI

●"*Now I use Neutral and Reverse like a taxi driver. My Scott-Atwater Shift motor is a honey . . . don't see how it could be improved!*"—*Joe Alexander, Madison 5, Wis.*

—SHIFT!—

**Scott-Atwater announces amazing new Model 1-30... now offers 4 Shift models**

America's most advanced outboard—with 1-to-30 m.p.h. performance, the *Shift*, more ball-and-roller bearings than any outboard its size, separate 5-gallon "stowaway" gas tank, exclusive steering-handle control of spark *and* throttle!

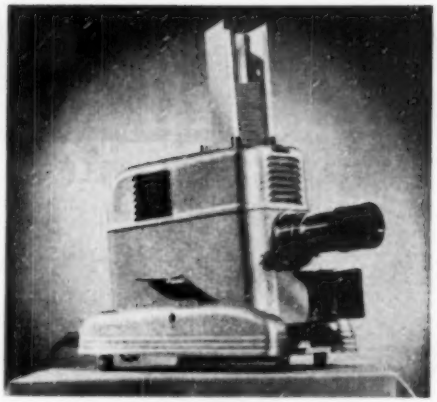
†WEST COAST PRICE SLIGHTLY HIGHER

*OBC CERTIFIED @ 4200 RPM **OBC CERTIFIED @ 4000 RPM

SEE FOR YOURSELF... SHIFT FOR YOURSELF...

**Shift to Scott-Atwater**

Dept. 36. Scott-Atwater Mfg. Co., Inc., Minneapolis 13, Minn.

## Automatic Slide Projector

REMOTE, push-button control enables the operator of this new projector to change slides while standing in front of his audience. Another feature is that all feeding, changing, and restacking of the slides is completely automatic. Since they are handled only once, when being arranged in sequence, the glass slides or ready mounts remain free from fingerprints. It is made by La Belle Industries, Oconomowoc, Wis.

## Regulate Your Own Watch

THIS new Croton Aquamedico® wrist watch can be regulated to split-second accuracy without opening the case. The waterproof and dustproof outside regulator is built into the back, as shown above. It is synchronized with the regulator control in the watch's movement inside. A slot in the outside control permits it to be adjusted with a dime coin, in accordance with "slow-fast" graduations engraved on the case.

**Riders of HARLEY-DAVIDSONS Won 17 NATIONAL CHAMPIONSHIPS Set 7 all-time records in 1949**

100-mile National Road Race
100-mile National Speedway
Jack-Pine National Endurance Championship
45" and 80" National Tourist Trophy Championships
Five Class "C" National Hillclimb Championships
**Track Championships** (One-mile track)
10-mile National
15-mile National
20-mile National
25-mile National
**Track Championships** (Half-mile track)
5-mile National
7-mile National
8-mile National

# HARLEY-DAVIDSON
## HYDRA-GLIDE MOTORCYCLE

Choose the motorcycle of the champions, the favorite mount of the racing stars! Experience for yourself the unequalled thrills of champion performance . . . acceleration that shoots you ahead like a rocket . . . power that makes steepest hills seem like straightaways . . . comfort that lets you ride all day without tiring . . . quality that gives you years of service. Fascinating fun and friends are yours at exciting race meets, hillclimbs, gypsy tours, club events and parties. There's no sport like motorcycling, no motorcycle like the world-champion Harley-Davidson! And you can own one on easy terms! See your dealer today. Mail the coupon now.

**HARLEY-DAVIDSON MOTOR CO., Dept. PS, Milwaukee 1, Wisconsin**

Send me free copy of thrilling ENTHUSIAST Magazine filled with motorcycle action pictures and stories; also literature on new models.

Name.....

Address.....

City..... State.....

**DEALERS:** Valuable franchises are now available for the full line of famous Big Twins and the 125 Model. This is your opportunity to line up with the greatest name in motorcycles. Write or wire for complete information today.

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Save money on every radio need! Get the 196-page 1950 ALLIED Catalog featuring the world's largest stocks of top-quality equipment, at low, money-saving prices! Latest TV releases, home radios and radio-phonos, Amateur equipment, PA systems and High-Fidelity Sound, recorders, test instruments, builders' kits—plus thousands of parts, tubes, tools, books and diagrams. Get more for your money from the World's Largest Radio Supply House. Send today for your FREE copy of the 1950 ALLIED Radio Buying Guide!

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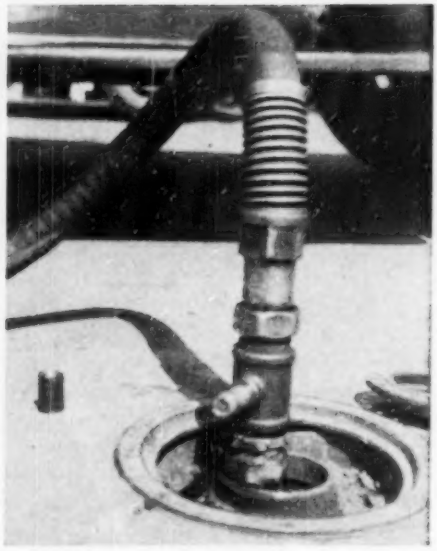


## Whistle Sounds Warning

THE tube sticking out from the gasoline-hose coupling above is a small siren that warns nearby smokers of dangerous fumes. It is operated by the vacuum created as the gasoline flows into an underground tank. The Gasiren® also guides the operator by ceasing to blow when the gasoline supply is depleted or the underground tank is overflowing. The Gasiren is made by the P. & M. Mfg. Co., of Escondido, Calif.

## Trouble Lamp Made Safe

THE portable extension lamp above has an added device to protect industrial workers from possible electrocution by accidental grounding in damp or wet locations. A step-down transformer—the large, black capsule at top—reduces a 110-volt current to a harmless six volts. The capsule, which weighs only 4¼ pounds, is protected by a waterproof Bakelite® covering that will withstand physical and chemical abuse. Called Saf-T-Lite®, the device is made by the Etraco Mfg. Co., of Flemington, N. J.

# TIME-SAVING TOOLS for SHOP and HOME

DREMEL ELECTRIC POWER TOOLS

*The Most Versatile Tool a Man Can Own*

## MOTO-TOOL

**Grinds, Routs, Drills, Polishes, etc.**

Moto-Tools, Kits and Accessories should not be confused with "bargain offers". Compare Dremel Products feature for feature, with other similar equipment. If ours are not superior in quality, design and performance, we don't want you to buy.

**Look at those MOTO-TOOL Features**

Dynamically balanced armature eliminates vibration. Oilless (oil-sealed) bearings ● Patented automatic chuck lock pin ● Snap-type sliding switch ● Cord protector ● Shockproof bakelite housing ● Dust-filtered air-cooling system ● Weighs 13 oz. ● Plugs into any 110-120 V. AC outlet ● Backed by over 13 years use in plants of General Electric ● Ford ● Remington Arms ● Nash-Kelvinator ● Westinghouse ● Douglas Aircraft, etc. . . . . plus a money-back Guarantee if not delighted after 5 days' trial.

**PRE-WAR PRICES STILL PREVAIL**

MOTO-TOOL KIT No. 2, with 23 accessories including high-speed steel cutters and Model 2 Moto-Tool in natural finish hardwood case $23.50

MOTO-TOOL No. 2 with one emery wheel point $16.50

*Portable* **Drill Press**

This 12" high, precision drill press is ideal for model making, wood carving, routing, etc. Utilizes No. 2 Moto-Tool. Only **$9.95** (Less Moto-Tool).

***Use Coupon to Order—***

**If your dealer cannot supply you.**

**DREMEL MFG. CO., DEPT. 120-B, RACINE, WIS.**

**FUN FOR BOYS FROM 8 TO 80**

## DREMEL COPING SAW

CUTS SCROLLS LIKE MAGIC—SANDS AS IT SAWS

**SAFE! AS A HANDSAW**

**JUST GUIDE IT!**

For men who harbor a hobby or do their own repair work . . . for boys who like to make things . . . no other tool will give so much pleasure and satisfaction in the home or workshop for the small amount of money invested as a Dremel Electric Coping Saw. It works in any direction . . . delivers 7,200 strokes per minute . . . so easily, there is no effort . . . so smoothly, work needs no sanding. Saws through ¾" medium-hard wood at a foot-a-minute speed. Touch-of-the-trigger, foolproof action. Only two moving parts, never needs oiling. Operates on 110-120 V. AC. Thousands and thousands of satisfied users.

Plans for making six useful, decorative projects packed with each Dremel Electric Coping Saw.

**MONEY BACK GUARANTEE.** If your dealer cannot supply you, use coupon to order direct from factory for five day trial.

**DREMEL MFG. CO., DEPT. 120-B, RACINE, WIS.**

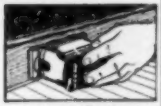
**3 TOOLS IN ONE**

**Only $14.85 POSTPAID**

Patented

## Dremel *Electric* SANDER POLISHER-MASSAGER

Say goodbye to hand sanding and polishing! This miracle machine is so easy to handle, a child can use it. Craftsmen and housewives find (1) **As a sander,** it takes the effort out of sanding walls, woodwork, furniture, workshop projects, etc. Its straight-line (non-rotary), action will not burn or scratch surfaces. (2) **As a polisher,** it does a professional job on waxed surfaces of cars, furniture, etc. (3) **As a massager,** it's ideal for tired or sore muscles.



Works Easily in Awkward Places

Sands Flat Surfaces Evenly

Makes Play of Wax Polishing

Soothes Tired Muscles

**LOOK AT THESE DREMEL FEATURES**

Dremel Sander delivers 14,400 strokes per min., weighs only 2½ lbs.; it's foolproof (has only two moving parts . . . never needs oiling). Dremel Sander operates on 110-120 Volt, 60 Cycle, AC. Thousands and thousands of satisfied users prove its outstanding value.

**SATISFACTION GUARANTEED**

Dremel Sander comes complete with 6 sheets assorted grade Garnet Paper for sanding, plus felt pad and sheepskin for polishing. If your dealer cannot supply you, use coupon to order direct from factory. **Money back if not delighted after 5 days' trial.**

**DREMEL MFG. CO., DEPT. 120-B, RACINE, WIS.**

**If Your Dealer Cannot Supply You USE THIS HANDY ORDER FORM**

**DREMEL MFG. CO., Dept. 120-B, Racine, Wisconsin**

Enclosed find $. . . . . (check or money order) in full payment for items checked below.

Enclosed find $2. Ship items checked below C.O.D. I'll pay postman balance plus postage and fee.

☐ Dremel Sander **$14.85** ☐ Dremel Coping Saw **$5.85**

☐ Moto-Tool Kit No. 2 **$23.50** ☐ No. 2 Moto-Tool, **$16.50**

☐ Drill Press **$9.95**

Send FREE Catalog on ☐ Moto-Tool ☐ Dremel Sander ☐ Dremel Coping Saw

Name . . . . . .

Address . . . . . .

City . . . . . Zone . . . State . . . . . .

Be Independent! Have your own business. Make $300.00 to $500.00 extra profit monthly

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"Pays for Itself" terms

*puts you in business with but little cash outlay*

Gas Drive Arc Welder

Why tie yourself down to routine work and limited pay when on-the-job arc welding is in such demand? Contractors, builders, farmers, businessmen gladly pay big money to men who have their own welders. HOBART'S new gas engine driven welders make your services even more valuable with faster, better welding. They run lights, motors, tools besides.

Generator Only . . . The same type generator used in HOBART's complete factory built welders is available if you want to "Build Your Own" portable gas drive welder. Made in all sizes and types. Saves $$$$ and lets you get started right away with minimum investment.

A.C. Welder, transformer type

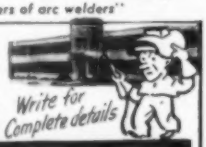
HOBART builds A.C. and D.C. Welders for shop or field. Write name and address in margin and send today for details.

HOBART BROTHERS CO., Box P-20, Troy, Ohio

*"One of the world's largest builders of arc welders"*

Hobart Training at Low Cost

Don't turn away from this fine opportunity if you lack welding experience. Let the HOBART Welding School help you become expert in short while. Low tuition, fully approved under G.I. Bill of Rights.



*Write for Complete details*

HOBART WELDERS



Can You Equal This Home for $2345

Shipped Direct from Our Mill

*Save 30% to 40% on Your New Home..*

Act Now!

Don't pay several hundred dollars more than necessary when you build a home! Buy direct from our mill at our low factory price. We ship you the lumber cut-to-fit, ready to erect. Paint, glass, hardware, nails, etc., all included in the price—no extra charges. Plans furnished—also complete building instructions. No wonder our customers write us that we saved them 30% to 40%. Easy terms—monthly payments.

Send for FREE BOOK of Liberty Homes

Handsome Big CATALOGUE

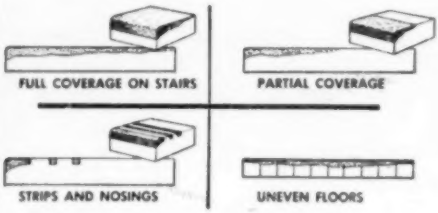
Pictures wonderful homes in colors at money-saving prices. Designs to suit everyone. *Write for your catalogue today.*

LEWIS MANUFACTURING CO.

1302 Lafayette Ave., Bay City, Mich.

## Guard Stops Flying Acid

WEARING this lightweight hood, a worker is safe from acid splashes. The window of the Chemgard Acid Hood® is made of replaceable vinyl plastic. The hood itself is made of flexible vinyl plastic, electronically seamed. Snap fasteners attach it to a white-coated vulcanized fiber headgear, adjustable to any head size. Ventilation is supplied through baffled vents. Mine Safety Appliances Co., Pittsburgh, makes the hood.




## New Cement Is Slip-Proof

WORN and uneven stairs and floors cause many accidents. The drawings above show how a new abrasive cement, Duracite®, is said to cure these tripping hazards, according to the manufacturer, Duane Specialties, of Newark, N. J. The product comes in powder form and is made into mortar by mixing with water. It will form a solid bond with such bases as slate, marble, concrete, or wood in six to eight hours.

# NEW POWER FOR YOUR CAR ENGINE!

**BY CONSTANT BALANCE OF LUBRICATING OIL SUPPLY**

## *Give Your Car this Tonic— Add Power, Pep and Performance*

# MARVEL INVERSE OILER

Here's the famous, low cost, auxiliary lubricating system that meters MARVEL MYSTERY OIL to critical upper cylinder engine parts, precisely in accordance with engine load. The compact INVERSE OILER functions inversely to manifold vacuum, retarding feed *visibly* when throttle is closed or at engine idle, an exclusive MARVEL feature! You can keep ring, piston and valve wear down and performance way UP this winter with the sensational MARVEL INVERSE OILER.

Learn about MARVEL MYSTERY OIL too—the famous oil improving Additive for YOUR motor oil that produces a slow idle, faster engine pick-up and an even, power pull. Thousands of car owners are using it in increased volume this winter for engine protection and to keep starts summer quick in cold weather and in ALL gear greases—it flows at 70° below zero!

**WRITE FOR THE FACTS NOW!**

*The* MARVEL INVERSE OILER *Is Easily Installed on Most Engines*

**EMEROL MANUFACTURING COMPANY, INC.**
**242 West 69th Street (Dept. P.S.) New York 23, N. Y.**

## INCREASE SAW SHARPENING PROFITS!

**REYNOLDS CIRCULAR SAW GRINDER**
Produces top quality results in fraction of time usually necessary for sharpening, jointing, gumming and tooth forming. Any hook or pitch of tooth and depth of cut is quickly adjusted. Both hands are free to control position of saw while grinding. Write now for free circular!

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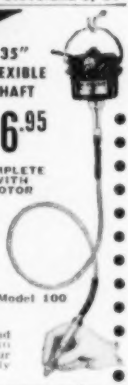
the choice of tens of thousands because: Pencil-size handpiece provides positive, sensitive, finger-tip control, works in hard-to-reach places. Your work always well in view. Precision construction and silencer-equipped flexible shaft assures smooth-running performance. Motor not dwarfed to fit the hand, hence more power, longer motor life. Price only $16.95 Foot rheostat $4.85 extra.

**Use It to Grind, Polish, Drill, Saw, Sand, Carve, Mill, Clean, Etch, Engrave, Etc.**
**on all metals, wood, plastics, glass, leather, linoleum, etc.**




**BUY THAT'S NOT ALL—**
For $4.95 extra get Foredom's new **Drill Press Attachment.** Magically and quickly converts machine into a power drill press.
**AND FOR ONLY $3.50 EXTRA,**
there's Foredom's new **B-R-S Attachment.** Makes machine serve **3 extra functions**—Bench Grinder with angular adjustment, Router with detachable guide for borders, and SHAPER.

Budget your purchase or buy
**FOREDOM MULTI-PURPOSE THREESOME**
comprising Model 100 Machine, Drill Press Attachment and B-R-S Attachment $24.95

**AND HERE'S ANOTHER AMAZING FOREDOM PRODUCT**

Now turn your old motor, drill press or electric drill into a Flexible Shaft Tool with FOREDOM PRESTO-FLEX with PENCIL SIZE handpiece. Attached or removed in a jiffy! Gets into tight places. Hands 35" overall length. And only $5.95 complete! Precision made. For use on motor, specify motor shaft diameter and add 50¢ for coupling. (Available for ¼, 5/16, ⅜, and ½" shafts.) No. 50 Accessory Set $1.50 extra.

**NEW ACCESSO-RAK.**
Mount on wall or back of bench and hang up machine. Comes with 40 highly useful accessories, all at your finger tips. Sensational value, only $4.95.

**ORDER TODAY. Send check or money order for items above or sent C.O.D. plus postage. Sold on 10 day money back TRIAL.**

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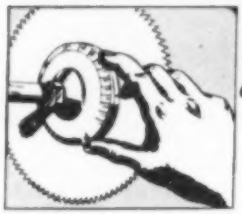
**FOREDOM ELECTRIC CO., Dept. 1026-E, 27 Park Place, New York 7, N. Y.**

*FOREDOM — Used by INDUSTRY — Preferred by HOBBYISTS!*

Better, Easier, Quicker
GROOVE CUTTING or CABINET-MAKING
with Warren DADO SAWING WASHERS



Just dial
DESIRED CUT

Cut accurate, parallel grooves—any width, any angle. Just dial desired width with Micromatic adjustment. Cuts smooth and clean—no burning or chewing to mar fine wood. Just four simple washers. Available in 5 sizes—½", ¾", ⅝", 1", 1⅛". Free booklet on request. See your dealer or write direct. Absolutely guaranteed! In Canada, send money order for $4.95 (duty and sales tax extra).

$4.95 A SET

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70 Medbury, Dept. 42, Detroit 2, Michigan

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A board or carload—Top grade kiln dried Mahogany—Walnut—Wh. Hd. Maple—Cherry—Poplar—Aromatic Red Cedar—Red, White and English Brown Oak—Sapeli—Andiroba—Balsa Wood. NEW LOW PRICES.

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The finest catalog we ever published. Full of unequaled bargains and useful information.

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Catalog shows in natural color 32 rare and fancy woods, 43 matched veneer designs, multi-colored bandings, inlays, overlays, 275 scroll patterns to choose from, labor-saving machinery and a section for beginner's instruction.

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My stocks are gigantic—bigger than ever before. Really FAST SERVICE on your orders. My new catalog includes a "gold mine" of hard-to-find hardware items. Whatever Wood Craftsmen need—I HAVE IT.

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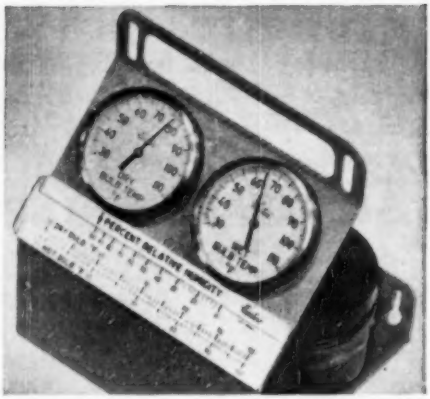
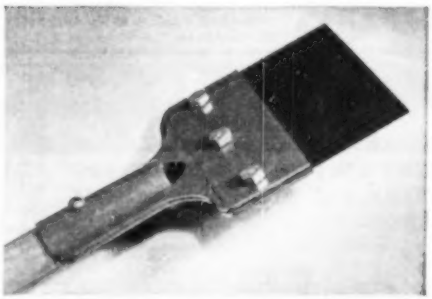



## Slide Rule Tells Humidity

You can tell immediately how humid it is by consulting the slide rule mounted at the bottom of this lightweight, wet-and-dry-bulb type of humidity indicator. Just move the ruler until the dial readings for the two thermometers meet on the lower scale: the relative humidity can then be read on the upper scale. Readings are accurate within one percent, report the makers. Designed for industrial use, the instrument can be swung when still air makes it necessary to start evaporation of the wet-bulb wick. Weston Electrical Instrument Corp., of Newark, N. J., makes the device.



## Scraper Blade Is Replaceable

It's easy to change the blade of this all-purpose scraper when it's worn out or you need a different type. Sturdy bolts through slots in its inner edge lock a blade to the handle. Blades come in either tool steel or brass (for jobs where there is danger of friction fires) with double-beveled or square-ground edges. The J K L Manufacturing Co., of Rockford, Ill., is the maker.

# *I'll Give You* 30 DAYS TRIAL

## To Test This Magnificent New 1950

# MIDWEST TELEVISION

## Console Right In Your Own Home

A. G. Hoffman
President

**You are the sole judge of the performance of Midwest Television. You must be satisfied or it is NO SALE! Your decision will not be influenced by high-pressure salesmanship but by what your eyes and ears, see and hear.**

**READ WHAT THESE FOLKS SAY about MIDWEST TELEVISION**

**"I Am Amazed At The Clearness of The Picture"**
Bayonne, N.J.—I am more than satisfied with my new Midwest "Constellation" Television Receiver. I really am amazed at the clearness of the picture, the fine reception, and the general attractiveness of the set. Midwest Television is everything you said it was, plus a whole lot more.

**Charles Naraza**
**661 Avenue "E"**

**"My Midwest Television and Radio Are The Best I've Seen"**
Wilkinsburg, Pa.—Recently I bought a Midwest Television Receiver Chassis to supplement my Midwest Series 16 AM-FM Radio and I am well pleased with both. In my estimation, my Midwest Television and Radio are the best I've seen. Please let me know if I can secure one of your large console cabinets to hold my complete outfit.

**David M. King**
**751 Ross Avenue**

**"My Midwest Is Worth Far More Than I Paid For It"**
Utica, N.Y.—I am writing you the letter because I feel that the wonderful Midwest Symphony Grand radio-phonograph which I purchased from you several months ago deserves a few words of praise. In my estimation, my Midwest is worth far more than I paid for it. Its performance on all bands is really amazing and its tone is without equal.

**Matthew J. Banash**
**1410 Francis St.**

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**Now In Our 30th Year Of FACTORY-TO-YOU Selling**

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**FACTORY-TO-YOU, A Line of Beautiful Consoles and Complete Chassis TELEVISION MODELS**

Here is Television at its finest! Brought to you by Midwest, the world's largest and oldest exclusive Factory-To-You radio and Television manufacturer. Giant new 16-inch Picture Tube receivers with 151 square inches of image . . . clear, steady, bright pictures . . . perfectly synchronized picture and sound that even a child can tune . . . new long distance FM sound circuit . . . big 12" Dynamic Panasonic Speaker. Available in beautiful consoles or complete chassis (not a kit) for custom installation in your own cabinet. Low Factory Prices, Long Easy Terms, and Liberal 30 Days Money-Back Trial. Send for FREE 32-Page, 4-Color Catalog.

*Send* TODAY FOR

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## NEW 1950 RADIOS

**featuring the New Long Distance FM Circuit and New 3-SPEED PHONOGRAPH**

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"SAVE IT AND FIX IT"

# FIXES

FURNITURE, DISHES, TOYS
BOOKS AND GLASSWARE

It's transparent, waterproof, flexible and durable. Get a tube today.

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**No. 000 ANGLE VISE**

*For MILLING—DRILLING—GRINDING FITTING—FILING*

**Solve Difficult Angle Jobs**

Quick, accurate set-ups at any angle. End make-shift methods —time loss—rejections. Ideal for tool rooms or home workshop. Accurately machined and graduated. Once set it stays locked. Jaws of steel—plain or grooved. PRICE $12.05 complete with Swivel Base. Write for other styles and sizes.

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For tool room, machine shop, school shop, home shop or repair shop. Accurately machined. Best semi-steel castings. Adjusting screw of hardened steel with fine pitch thread and long bearing. Jaws of steel, grooved or plain. Sizes 1½" — 2½" — 4" Jaws.

No. 6
1½"-GROOVED STEEL JAW. $4.

**No. 83 ROTARY TABLE with . . .**

**DUAL CROSS FEED and ROTARY FEED**

Has 8" Circular Table with full 360° movement and 4" crossfeed travel. Free moving adjusting wheels and dials graduated in degrees. Crossfeed adjusting screws have Acme threads with adjustable dials graduated in thousands. Four slots in base and key slots for bolting to table.
No. 83 Rotary 8" Table . . . . . $49.50
No. 82 Dual crossfeed—without rotary . . . . . $39.75

IMMEDIATE DELIVERY Write for Circular No. 12 — Order from dealer or direct postpaid if he can't supply.

**CHICAGO TOOL AND ENGINEERING CO.**
8396 South Chicago Avenue Chicago 17, Illinois
Telephone — Saginaw 1-9678


## *Knowing Auto Noises Can Speed Repairs*

EVERY auto mechanic has a lingo all his own to describe trouble noises. One man's "bump" is another's "clunk." A "hiss" may turn up as a "buzz," "wheeze," or "fry."

Hearing the noise, the experienced mechanic usually knows where to locate the trouble. But if you just drive in and ask him to "get rid of the squeal," he may go off on the wrong track.

To avoid misunderstandings between driver and mechanic, General Motors engineers have divided trouble noises into seven classifications. These are:

***The Rattle.*** A series of hard, sharp sounds in rapid succession, like a hard object being shaken around in a metal container. This noise usually indicates a loose or broken part striking against another.

***The Thump.*** A dull sound, generally made when a soft part strikes against a hard part. An example is the noise made by a deflated tire on the road.

***The Squeak.*** A sharp, shrill, piercing noise, generally made by two dry metal parts rubbing together. The sound may be sharp and erratic, or drawn out—a squeal. Lack of lubrication causes many squeaks.

***The Grind.*** This is a continuous crushing sound like a part being crushed between two revolving parts. Such a sound might come from the transmission.

***The Knock.*** This is a sharper and more distinct sound than a thump. It's generally associated with a loose rod or crankshaft bearing. (Not to be confused with the "knock" or ping of a laboring engine.)

***The Scrape.*** A grating or harsh rubbing sound, often made by two pieces of material rubbing together. The sound of a dragging brake could be described as a scrape.

***The Hiss.*** This is like escaping air or steam or the sound of water on a hot metal part.

These definitions are contained in a booklet, "How to Report Trouble," prepared by GMC Truck & Coach Division for distribution to coach drivers. Besides telling *what* the noise is, the driver is expected to report *where* it comes from and *when* it happened. With this report, the mechanic has a good start toward learning *why* it happened.

# THIS IS IT! *The saw all America Is Talking About!*

**#3001 with two Extensions $3.50 each**

It's America's outstanding circular saw value! Look at these quality features — features found only in saws costing much more: tilt/arbor design (your work and table are always flat for greater accuracy and safety), the blade cuts 2¼" deep, sealed ball bearings, precision-ground grey-iron table (25½" wide x 16" with two low-cost extensions), full length double-locking rip fence, convenient controls. For model and furniture building, and home improvements, there just isn't a better value anyplace! See it at your Power King dealers, or send for catalog. Note special free furniture-making offer.

**FREE!**

Popular Science, as a public service, has permitted reprint of its December article showing how to make 9 furniture pieces at low cost. Get a copy from your PK dealer, or send this coupon.

**ATLAS PRESS COMPANY**
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Please send the furniture-making booklet and latest PK catalog.

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MATCHED PRECISION TOOLS FOR WOODWORKING AND METALWORKING

A WORKSHOP WONDER
*at a wonderful* LOW PRICE

25 piece set only $14.95

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DRILLS • SAWS • ETCHES • POLISHES

Casco's ELECTR-O-TOOL kit is the most *complete, practical* power-workshop any craftsman or hobbyist can own. Has ALL the accessories you need to drill, cut, etch, carve, grind, buff, polish, sand, engrave, saw, clean and sharpen — metal, wood, glass, leather, plastic and fibre. 1001 year-round *money-saving uses.* Operates on AC and DC current. Fully GUARANTEED.

Now on sale at Department, Hardware, Appliance, Auto Accessory and Jewelry stores.

*Light your way to*
SAFER CAR SMOKING

WITH A CASCO
ILLUMINATED "POP-OUT"
CAR CIGARETTE LIGHTER

Casco's VIS-O-LITE car lighter has an illuminated well that guides the lighter swiftly back. Eliminates fumbling in the dark . . . prevents scratched dashboard . . . keeps your eyes on the road. Now on sale at Dealers, Auto Supply Stores and Service Stations, only $2.75

VIS-O-LITE illuminating well-assembly (minus pop-out unit) . . . $1.25
Replacement pop-out unit . . $1.25 Replacement element . . $1.00

CASCO Products Corp.
Bridgeport 2, Conn.

## Plastic Cover Protects Top

You can't see it here, but this convertible top has an all-weather protective covering. It's made of thin-gauge, clear plastic, reinforced at the edges and shaped to conform exactly to the contour of the fabric top. Stretched tight, the cover doesn't detract from the appearance of the fabric top, and it can be left on when the top is raised or lowered. It can be washed with soap and water. The Winterseal Co., of Chicago, makes the cover.

**Ball-Tilt Milling Table.** The Leo G. Brown Engineering Co., Los Angeles, makes this milling table that'll tilt 30° in any direction. The ball angle adjustment is made by loosening one of the three hollow-head screws. Over-all height of the table, when level, is 6½"; weight is 50 lb. The table is priced at about $115.

## Seal Wood Before Puttying

BEFORE puttying windows, seal the wood frame with a coat or two of paint. Putty applied to raw wood dries out rapidly because the wood absorbs oil from the putty. —*Joseph E. Bird, Carrollton, Ill.*

DELTA
MILWAUKEE

Model No. 37-595

$235.75

Motor and switch rod extra

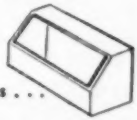
**Easy time payments!**

Price subject to change without notice

# Cuts costs, boosts output!

For pattern makers . . .

. . . For builders



For cabinet makers . . .

. . . For furniture makers

For sign shops . . .

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For *everybody* who cuts wood!

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Saves space, both 10" tilting-table saw and 6" jointer mounted on one steel stand and driven by the same motor. Saves the cost of an additional motor. Saves on power costs, too.

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See at first hand how you save space, time, and money with a Delta-Milwaukee Saw-Jointer Combination. Have your Delta dealer demonstrate it today.

Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

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*CLEAN, QUICK, EASY*

IT'S ORANGE!

One coat usually lifts off all paint, varnish, and synthetic finishes. Stays wet longer. Semi-paste — will not run or drip; needs no after-wash. Harmless to hands or surface. Pint 65c, does a large table. Sold where you buy paints.

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BALL BEARING **ARBORS** $6.95

Rugged aluminum alloy housing, heavy duty sealed ball bearings, precision steel shaft 1/2", 5/8" or 3/4", RH or LH thread.

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| 2¼x4" | 7½" | $6.95 |
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BALL BEARING PILLOW BLOCKS $3.00 ea.

Same bearings as arbors. Sizes 5/8" and 3/4". Shipped immediately postpaid. Write for FREE Catalog or Order today. You will be pleased.
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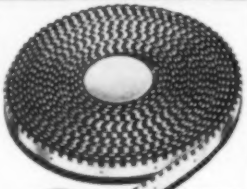
WEATHERPROOF YOUR HOME WITH *Nu-WAY* WEATHER STRIP

Easiest strip in the world to put on. Can be used on most any type door or window. Wool felt, reinforced with white metal.



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MACKLANBURG DUNCAN CO. QUALITY PRODUCTS

BUY AT YOUR LOCAL HARDWARE STORE, BUILDING SUPPLY DEALER OR LUMBER YARD



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*Exclusive* DOUBLE ARC MOTION *New*

14,400 RAPID POWER STROKES A MINUTE

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**SYNCRO** ELECTRIC SANDER POLISHER MASSAGER

Amazing new device for light sanding, polishing and body massaging ready! SYNCRO sands, polishes in tight places, corners, around mouldings and on flat, curved or irregular surfaces. Just guide it! Easily adjustable stroke! 60 cycle, 110-120 volt AC. With 10 sheets sandpaper, fabric, lambswool pads, cord, plug, $14.50 at Dealers! If he hasn't, send $14.50 to factory, we'll ship Sander postpaid. See *other* Syncro products pages 270, 282. (Dealers write!)

SYNCRO CORP., DEPT. PM-25, ROCHESTER, MICH., U.S.A.

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**PALLEY FAMOUS MIXES!!**
Here are assortments of Hinges, Springs Nuts & Bolts, Rivets, Files, Pulleys, etc. Especially prepared for you home-craftsmen and gadgeteers.

**GADGET MIX** – Rivets, Spacers, Bolts, Screws, Gears, Wheel bearings, Springs and Clamps. No. 106, 5 lbs. . . . . . **1.19**

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**FILE MIX** – Ten assorted Files, 4" to 12", includes 3 Vixens, half rounds bastards, mills, etc., in seconds and used but in good condition. 1 Vixen alone worth our price for entire mix. F-1 **99c**

**PULLEY MIX, No. PM-1** – You'll want this one around. 10 micarta & metal pulleys ranging from 1" to 5" with ball and one piece bearings. These are aircraft pulleys, the best made with 100's of uses. A WONDERFUL BUY!!! **2.95**

**COUNTERSINK MIX, No. 168.** Wide assortment. Excellent condition. High speed steel. Assortment of ten 100° and 110° with pilot sizes ranging from 3/32" to 3/16" No. CM-1 **2.69**

**SCREW MIX** – 5 lbs. incl. 2½ lbs. wood screws & 2½ lbs. machine screws. All sizes. Save dollars and always have plenty of screws on hand. . **1.39**

**NUT MIX NM-1** – 3 lbs. approx. 500 nuts. Anchor, Lock, Castle, Hex, Elastic Stop Nuts, etc. You'll always have plenty of Nuts in the shop. NM-1 **1.39**

**SUPER COMBO MIX** – No. SC2. Here's a real bargain. All eleven of above mixes for ONLY . . . . **12.95**

**REAMER MIX** – No. 168. Reamer assortment: Special Taper line finish Reamers. High Speed Steel. Slightly used but in excellent condition. Ten assorted sizes ranging from .168x.165 & .244x215 to .425x.385 & .432x.403. One alone worth our selling price of ten. For set of ten Reamers . . . **4.49**

**PLASTIC MALLET** CLEAR PLASTIC with 2" dia. x 4" head & 12" handle. For soft metal or plastic work where non-marking or light tapping is desired. **79c ea.**

**15" MONKEY WRENCH**
Adjustable Jaw – Opens to 4"
Drop Forged. . Auto Type.
Cadmium Plated **89c** Black **79c**

**PIANO HINGE**

| Overall Width | | Length | Price Ea. |
|---|---|---|---|
| 1¼" | (5/8" side) | 72" alum. | $1.00 |
| 1½" | (3/4" side) | 53" cad. steel | $0.75 |

**PALLEY SUPPLY COMPANY**
6321 SAN FERNANDO RD.
DEPT. P.S. 2 GLENDALE 1, CALIF.

**HEAVY DUTY WINCH**
GENUINE U.S. SURPLUS

Only 139.95
**7½ TON – GAR WOOD**
Here's brute power for all lifting operations in shops, garages, foundries, factories – tow-trucks, etc. The Army used these on their "Cle-tracs". (M-5) Worm gear drive, power driven from 1½" take-off. Cable drum is 15" wide-16" dia. with 6" core. Holds approx. 200 ft. 5/8" cable. Has disengaging clutch & mounting brackets. This winch cost the Gov't many times our price of . . . . . . . . . . . . . . . . . $139.95

**No. 100 WINCH HOIST**
A sturdy, dependable hoist, originally used as bomb hoist in B-29's. Capacity 2500 lbs. with 24 to 1 gear ratio. Has bronze worm gear and drum has 19 ft. of 1/4" flex. steel cable with hook on end, and two speed handle. Ideal for shops, garages, tow-trucks, boats. . . . . . . . . . **$21.99**

**Sperry Aircraft Directional GYRO COMPASS**
Dial is 360° swing calibrated 1/10° (6 min), Panel Mount 4½" square with 3" luminous dial. Can be used in autos, planes, or boats by attaching one tube to intake manifold for required vacuum. Complete with reset caging knob. Gov't. overhauled – ONLY . . . . . . . **$4.49**

**U.S. NAVY BATTLE LANTERN** – A powerful lamp complete with 2 1½ volt dry cell batteries. Size: –" x 7" x 4" . . . . **3.29**

**AIRCRAFT CABLE**
Rust resistant alloyed steel, extra flexible, preformed – 7 x 19 strand-on reels.

| | | | |
|---|---|---|---|
| 1/16" | 3¢ ft. | 1/4" | 8¢ ft. |
| 3/32" | 4¢ ft. | 9/32" | 9¢ ft. |
| 1/8" | 4½¢ ft. | 3/8" | 12¢ ft. |
| 5/32" | 5¢ ft. | 1/2" | 15¢ ft. |
| 3/16" | 6¢ ft. | 1/4" Bronze | 14¢ ft. |

1/8" Stainless Steel, per. foot . . . 12c
Aircraft control cable 18 ft. long, 3/16 in. diam. with turnbuckle ends. 99c ea.

**OXFORD BRG & TOOL SCRAPERS**
Complete set of 6 Tools packed in Grained Wood Case. Contains: 1 ea. 8", 10", 12", 14" half round scraper. 1—6" Three square Scraper. 1—12" Double end Scraper. Made of Finest Tool Steel. Forged. Tempered. and Hollow Ground. An Unheard of Price! SET **$2.49**

**NEW PRESSURE TANKS**
Stainless Steel, Shatterproof & Rustless. Ideal for painting, cooking, spraying, ocean buoys, underwater fishing, or diving.
G-1–12½x24 inches. 2100 Cu. In. capacity . . . . . . . . . . . NEW **4.75**
F-1–10x18 inches. 1000 Cu. In. capacity . . . . . . . . . . . USED **4.19**
F-2–6x45 inches. 1000 Cu. In. capacity . . . . . . . . . . . NEW **3.95**
D-2–6½x24 inches. 500 Cu. In. capacity. Stainless Steel Construction . . . . . . . . . . . USED **3.49**
D-2A–Corrosion resistant steel. Same as D-2 . . . . . NEW **2.49**
A-6–5½x15 inches. 280 Cu. In. capacity . . . . . . . . . . . USED **2.25**
A-4–5x8 inches. 104 Cu. In. capacity . . . . . . . . . . . . NEW **1.35**
NOTE: All tanks listed as used are guaranteed servicable and free from leaks or dents.

**FIRE EXTINGUISHER**
Kiddie Lux $CO^2$ Type. Built to Gov't spec. Shatter-proof, heavy case. Fully re-charged, with horn
No. 601C–2 lb. wheel control . . . . . . . . . . . **11.75**
No. 602A – 7½ lb. $35 Value.. **19.25**
No. 603 – 10 lb. A $65 Value. . . **25.75**
No. 605-A – 15 lb. New. Break disc Type. A $75 Value . . . **29.75**
No. 605-B – 15 lb. Wheel Control Type . . . . . . . . . . . . **32.95**
No. 605-C – 15 lb. New. Squeeze Grip Type. $85 Value . . **39.95**

**TWO HEAT SOLDERING IRON**
World's Hottest Iron Value!
Two soldering irons in one with button heat control. Push the button—Select 150 or 300 Watt heat for light or heavy work. Complete with tip, bench holder, 5' asbestos cord. 110V AC. A $15.00 Value For . . . **3.95**

**16mm MOVIE GUN CAMERA.** Has semi-telephoto 1 3/8" (35 mm) lens with yellow filter – 3 shutter speeds for normal (16 frames) semi-slow motion (32 frames) and slow motion (64 frames per second). Uses any standard Eastman film magazine or Type 'G' AAF magazine. Takes Black & White or Full color pictures. Operates on 24V (dry cell batteries) & require slight conversion for hand use. Diagram furnished. Cost Gov't $235.00 – NOW . . **24.50**

**CONVERTED GUN CAMERA** – Fully reconditioned with start switch on front. Choice of finishes – Gray, Black Blue . . . . . . . . . . . . . . . . . **33.95**

**VIEW FINDER** – Calibrated for above lens . . . . . . . . . . . . . . **8.75**

**FILM** – Standard, type "G" magazine – Fits gun camera and many other standard 16mm cameras – Loaded with 50ft. black and white film – Price includes processing. **2.25**

**D. C. GENERATORS**

Suitable for adaption to home welding units, portable and rural lighting, power plant on boats, etc

| TYPE | AMPS | VOLTS | |
|---|---|---|---|
| P1 | 200 | 27/A | 17.95 |
| R1 | 300 | 30 | 29.75 |
| E5A | 50 | 12 | 14.95 |

Used but Guaranteed Condition

**D.C. METERS**

| AMMETERS | |
|---|---|
| - 30 - 0 - 30 + | 0 - 120 |
| - 60 - 0 - 60 + | 0 - 240 |
| -120 - 0 - 120 + | 0 - 300 |

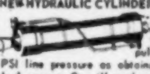
VOLTMETERS 0–30 $3.95
Your choice 3.95 ea.
COMBINATION VOLTMETER - AMMETER
30V – 30 AMP
30V – 60 AMP $4.95
All meters 2" face except 0-300 which is 3" face.
SHUNTS - Required for use with D.C. Ammeters 30–60–120–240 SOLD ONLY WITH METERS. $1.00

**NEW ELECTRIC MOTORS**
No. 500 – New ½ HP – 27 Volt DC-AC. This motor can be readily adapted to deliver up to ½ HP on 110 Volts AC by the simple method of rearranging armature brush-leads. Free diagram with each order. A sensational Value . . . . . **$5.95**
No. 500-A – Converted to 110 Volts-AC Equipped with plug and 3½ ft. Heavy Duty Cord . . . . . . . . . . . . **$8.49 ea.**
No. 502 – 2 HP-24V. DC Motor Used . . . . . . . . . . . . . . . . . . . . **$8.95**

**OXYGEN & ACETYLENE REGULATORS**
OXYGEN REGULATOR - - Bottle Press. Guage - 0–3000 PSI. Regulating Press. Guage - 0–400 PSI
ACETYLENE REGULATOR - Bottle Press. Gauge - 0–500 PSI. Regulating Pressure Gauge - 0–50 PSI.
AIRCO & Other Popular Makes to fit ALL Standard Bottles - - ALL NEW!! A Real Buy at . . . . . . . . each **$12.95** or Both for . . . . . . . . . . . . . . . . **$25.00**

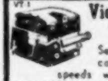
**PNEUMATIC AND AIR TOOLS**
10,000 in various popular makes, sizes, types, Cleco, Aro, Ingersol Rand, Chicago, Pneumatic, Buckeye, etc.
#100 **RIVET GUNS** Pistol & Gooseneck Type $65 VALUE **$8.95**
Gooseneck Pistol
**SPECIAL**
Air Drill or Air Motor with 1/4" Jacobs chuck. ARO PISTOL **$17.95**
Send for Catalog and List of Other Sizes, Types of Pneumatic Tools.

**92 PAGE CATALOG**
War Surplus – Tools, Machinery, Raw Materials, Clothing, etc. Illustrated with valuable info., tables, charts & data. Send 25¢ to cover handling & postage.

**NEW HYDRAULIC CYLINDER SPECIAL**

Gives 20,000 lb. thrust (push pull) using 1500 PSI line pressure as obtained from our hyd. pumps. Or will produce 40,000 lb. thrust with 3,000 lb. line pressure. CAN ALSO BE OPERATED ON LOW PRESSURE AIR SYSTEMS. 4" Bore, 1½" dia. piston shaft, 18" stroke, length 30½". Equipped with ball bearing loaded clevis type mounting and swivel type high pressure steel pipe bracket for easy use. Ideal for road, farm & shop machinery, presses, etc. Cost Gov't $390.00 **22.50**

We carry the World's Largest Supply of New Hydraulic Equipment featuring over 20,000 Cylinders in 61 Sizes & Types. Can also supply all accessories such as Pumps, Fittings, Valves, Tanks, Hose Fittings. Let us solve your Hydraulic problems. Write for information.

**BENDIX HYDRAULIC HAND PUMP**
Provides an instantaneous source of tremendous power for almost any heavy work. Double action stroke. Delivers .30 cu. in. per cycle at 3000 PSI. Max. press. 5000 PSI. Built-in Reservoir cap. 2¼ qts. 3/8" pipe outlets. Has Pressure Release Valve. 7⅛" dia. by 23 3/16" overall ht. Weight 15.2 lbs. A $40.00 Value for... NEW **$15.95**
Used - In Good Condition... **11.95**

**Vickers Hydraulic Transmission**

Self contained, 2 H.P. constant torque at all speeds with variable volume reversible, piston pump (controlled by outside lever) supplying piston hydraulic motor. Automatic pressure, dash pot for smooth control. Power output R.P.M. - O to 1/3 input R.P.M. in both directions. Input R.P.M. 1800 continuous 4000 intermittent. Dash pot can be removed for greater R.P.M. Ideal for Lathes, Duplicator Setup on Mills, Conveyors, Small Cars, Drives, Gearing, etc. Includes 2-4" Spline Shafts for input & power take-off - Cost Gov't. approx. $400. **$27.50**

**GEAR BOXES** VTG-1 – 90°, bevel gear 1½ to 1 reduction, size 7" x 6". A Lifetime Value. . . . . . . **$3.95**
VTG-2 – Inline spur gear 16 to 1 reduction, thru 4 gears. Final take-off 4½" dia, 26 tooth. ¼" Alum. spur gear. . **$6.49**
Both above gear boxes have lever control for engaging & disengaging positive clutch. Dust proof housing. Prelubricated bearings. Both can be adapted to Vickers Transmission.

**VALUABLE GEAR BARGAINS!**
8 to 1 ratio, spindle drive #110 . . . . . . . . . $2.98
6 to 1 with screw shaft #111 . . . . . . . . . $4.98
85 to 1 (can be used for radio, antennae, etc.) . . #112 . . **$3.95**
#G-11 - 10-1 gear ratio . . . . . . **$3.95**

**ELECTRONIC TRANSMISSION GEAR TRAIN**

GT-1 Containing approx. 50 Bronze Spur & Pinion Gears – ranging from 3/8" to 4" dia., 5 sets of 7 cluster gears, 2 complete worm & worm gear drive sets, 40 N.D. ball bearings from ⅛" to 1½" dia. watch springs, bushings, posts, face plates, housings – Micro Switches, 2 miniature, controlled clutches, etc. 19 lbs Of Pleasure and profit. A Tremendous Gadget Mine. ONLY **$9.49**
Gears in above train are all in multiple size & sequence with identical teeth ratio giving 100's of ideal gear reduction comb.

Order from this Ad. All sales final. All Prices F.O.B. Los Angeles. Pay by M.O. or Check. P.O.'s Accptd. from D & B. firms. ⅓ deposit with C.O.D's.

*THE LARGEST FIRM OF ITS TYPE IN THE WORLD*

## The JIFFY metal CABINET

**YOUR ANSWER TO SMALL ITEMS STORAGE** at home, office, and shop (IDEAL GIFT, TOO)

So handy to keep nuts, bolts, screws, nails, parts, washers, stamps, hobbyists' needs, etc., at your fingertips.

THIS 32 DRAWER UNIT ONLY $5.95 POSTPAID

Stop searching, get a 32 or 64 drawer Jiffy to keep those small items that usually get mislaid. Spot welded steel, gray enamel finish, metal drawer guides. Dividers included with aluminum drawers make possible three compartments per drawer. Looks good anywhere. Send check or money order, please—no C. O. D.'s. Prices below. Your money refunded if not satisfied. Dealers write for quantity discount.

| SPECIFICATIONS | WITH ALUMINUM DRAWERS | WITH CARDBOARD DRAWERS |
|---|---|---|
| **32 Drawer Unit**<br>6" Deep<br>12¾" Wide<br>15¼" High<br>**64 Drawer Unit**<br>6" Deep<br>25½" Wide<br>15¼" High<br>**Drawer Size**<br>1¼" Deep<br>2¾" Wide<br>6" Long | **Dividers and Index Cards Included**<br>One piece rustproof aluminum drawers for heavy service — good for work bench and industry use.<br>**32 drawer - $8.95**<br>**64 drawer - $15.95** | Suitable for most home uses. Heavy board kraft covered. Metal drawer pulls.<br>**32 drawer $5.95**<br>**64 drawer $9.95** |
| | Ohio orders add 3% sales tax. Marproof Rubber Feet included with all cabinets | |
| | POSTAGE PAID | POSTAGE PAID |

**KAYTEE PRODUCTS, Dept. S. Box 588, Canton, O.**

## HAGERTY SEA SHELL ONLY $35

MAKE every week end a real vacation! Take along your HAGERTY SEA SHELL! Handy and light (65 lbs.) for easy carrying, easy rowing. Rugged for years of service. Takes a small outboard. Kit easily assembled in a few pleasant evenings! Holds 3 adults in safety. Ideal for all-around use. Over 15,000 in service. Fully guaranteed.

**THIS 8-FOOTER SAVES YOU MONEY**

Put the SEA SHELL together and save half the cost of a ready-made rowboat. It's fun! Only ordinary hand tools needed. Kit includes pre-cut waterproof plywood and wood parts, screws, oarlocks, seam compound, full instructions. Beam 4 ft., depth 16 ins. Sailboat conversion kit available.

**HAGERTY,** 102 Front Street, Cohasset, Mass.

☐ Please send me FREE booklet, name of nearest dealer.

☐ Please send SEA SHELL kit, freight collect. Enclosed is $35.

*Name* _____

*Address* _____

*City* _____ *State* _____

## Every Electric Drill A PORTABLE SAW

**CAN BE USED WITH ONE HAND!**

Just try it! You won't use a hand saw anymore

FITS ANY ¼" ELECTRIC DRILL

**$9.95**

"ARCO-SAW" is a rugged precision woodcutting tool with right angle gear drive. (No clumsy direct drive with drill sideways.) Works like high priced Portable Saw. EXCLUSIVE SAFETY YOKE connects drill and saw. ABSOLUTELY SAFE TO USE. All Parts Guaranteed.

**Cuts 1½", 2 x 4 BY TURNING OVER**

**DEALERS:** Write for name of nearest wholesaler.

5 DAY MONEY BACK GUARANTEE

**ORDER YOURS TODAY at your Dealer or send M.O. or Check for $9.95 (compl. with 4" "Hycarbon" Blade)**

Extra Crosscut Blade, Will Rip & Mitre ..... $1.60

**ARROW METAL PRODUCTS CO.**

Dept. PS-2, 140 West Broadway New York 13, N. Y.

## Ask Your Hardware Store for FULLER'S *Unbreakable Amber Handle* SCREW DRIVERS

America's most popular line of moderately-priced screw drivers! Wide range of sizes.

**FULLER TOOL CO., Inc., 911 Falls St., New York 59**

*World's largest maker of Amber-Handle Tools*

## NOW! FILE YOUR OWN SAWS

Do expert saw filing at home. Precision filing easy without experience. Two simple adjustments. Keeps any hand saw extra sharp and true-cutting. Complete with file. Money back guarantee. Cash with order, prepaid. (COD postage extra.) Order today.

**Another Speedcor Tool**

**THE SPEED CORP., PS-2**

**512 N.E. 73 Portland 16, Oregon**

## HIGH POWER TELESCOPE

***60 POWER-ALUMINUM TUBES-OPENS TO 33"***

**Variable Power Eyepiece Adjustable to 15X, 30X and 60X.**

**4.50** Leather Case Included

5 Sections. 4 Ground & Polished Lenses. Also used as 50X Microscope. Ready to use, only $4.50 POSTPAID.

**BROWNSCOPE CO.** Dept. 2P, 24 W. 45th St., NEW YORK 19, N. Y.

## *Nearest thing to* GLASS WALLS

Brighter interiors with amazing INDORLITE WHITE Enamel. Whitest White you ever saw . . . and STAYS WHITE . . . the nearest thing to Glass Walls.

For kitchens, bathrooms, basements, work rooms, etc. Brings in the sunshine, raises spirits, improves efficiency. Washable, long-lasting and always gleaming, pure WHITE.

Easy to apply, economical. "Only Indorlite is as white as Indorlite." Accept no substitute. If your dealer can't supply, write us! Descriptive folder FREE.

COLONIAL WORKS, INC.

225 NORMAN AVENUE, BROOKLYN 22, N. Y.

# WAR SURPLUS BARGAINS

## SHOP by MAIL - SAVE at GROBAN'S

### Gear Type—All Manganese Bronze INSECTICIDE PUMP

**For Spraying D.D.T., 2,4-D, Sulphur Compounds, etc. BRAND NEW.** Pressures up to 200 lbs. and 14 gallons per minute—at 1200 R.P.M. Will not rust, pit, foul or freeze up. Use rubber hose inlet, ⅜" pipe outlet. Equipped with double mounting bracket. Weight 24 lbs. Dimen. 8"x7"x10". Stand-and 1" manganese bronze shaft with keyway. **U. S. Govt. Acquisition Cost $42.00. NOW** (ITEM #50) **15.00** F.O.B. Chicago

**FREE—complete instructions and performance data with each pump.**

### LOGAN HEAVY DUTY HYDRAULIC CONTROL VALVE

**BRAND NEW** control valve with built-in adjustable relief valve, will operate one double-acting hydraulic cylinder or two cylinders as one or a reversible hydraulic motor. Valve handle latches in neutral position. Made of rugged cast aluminum alloy. Open center unloads the pump in neutral position. Throttling control allows operator to regulate the speed of movement of the hydraulic cylinder or motor. Has removeable mounting brackets with 4 bolt holes. ⅜" pipe thread connections. Overall dimen.: 12½"Hx8½"Dx8"W. Ship. wt. 17 lbs. Govt. Acquisition Cost Over $160.00. An Excellent Buy ..... F.O.B. Chicago **21.95** (ITEM #37)

### AIR or OIL HYDRAULICS

**Use hydraulics on arbor presses, hydraulic presses, hay lifts, manure loaders, lift trucks—push or pull, tilt or turn, press or squeeze, open or close, lift or lower—and other hydraulic and industrial applications. Use with either air or oil . . . of finest precision workmanship. BRAND NEW.**

**ITEM #16**—Use these cylinders on farm trucks, bulldozers, hay lifts, manure loaders, etc. Double action, 1½" bore, 27" stroke. (Will lift 1760 lbs. in 2 seconds with Logan Pump.) Wt. 6 lbs. A $55.00 hydraulic cylinder value for only ... postpaid **12.95**

**ITEM #17**—Double action, 2½" bore, 8" stroke. (Will lift 4400 lbs. in one second with Logan Pump.) Will withstand 1500P.S.I. against wall. Wt. 7 lbs. A $65.00 value. Postpaid **14.50**

**ITEM #18**—Double action, 3" bore, 8½" stroke. All steel hydraulic cylinder. (will lift up to 7000 lbs. in 3 seconds with Logan Pump). Wt. 12 lbs. A $78.00 value. Postpaid **19.50**

**ITEM #31. Double action,** 3½" bore, 11" stroke. (Will lift 9600 lbs. in 7 seconds using Logan Pump.) Wt. 15 lbs. A $92.00 value ..... postpaid **22.50**

**ITEM #42**—Double action hydraulic cylinder. 4" bore, 18" stroke. Rated lift capacity with 1000 P.S.I. input is 12,560 lbs. using Logan Pump. Ship. wt. 30 lbs. AN EXCELLENT VALUE for ..... F.O.B. Chicago **32.50**

**HI-PRESSURE FITTINGS for cylinders and valves available at 35c ea. for ⅜" pipe and 50c ea. for ½" pipe.**

### Hydraulic Control Valve

**ITEM #24.** Four-way control valve with built-in relief valve, for use with one double action hydraulic cylinder, may be used with 1500 P.S.I. hydraulic system to open and close hydraulic cylinders. Brand new. Ship. wt. 8 lbs. A $38.00 value ..... postpaid **7.95**

**ITEM #26.** Four-way control valve for use with two hydraulic double-action cylinders. Each cylinder may be operated independently of the other or in conjunction with the other. Oil may be locked in any of the cylinders to hold the piston at any required position. Brand new. Ship. wt. 9 lbs. A $60 value ..... postpaid **10.95**

**ITEM #28.** A two cylinder double action valve with a unique arrangement, allowing the operator to raise both cylinders simultaneously, to lower them simultaneously or to raise one and lower the other at any predetermined rate and speed. Brand new. Ship. wt. 8 lbs. A $75.00 value ... wt. 8 lbs. A ..... postpaid **14.95**

### VICKERS MFG HYDRAULIC PUMP or MOTOR

**Complete with mounting kit ready to install**

$75.00 Value **19.90** postpaid

Pump is compact, powerful, rated 1,000 P.S.I., .307 cu. in. per revolution, 8 gal. per min. at 3750 RPM. Change rotation by reversing flow. Delivers up to 6 H.P. Requires ½ to 6 H.P. to drive directly or by pulley. BRAND NEW. Mounting kit has been especially designed to provide maximum utility and ease of mounting MP Series Vickers Pumps. Brackets are constructed of heavy steel plate; shaft is made of ½" steel with one end splined to fit pump; other end of shaft has machined flat for mounting a standard pulley with ½" hole. Shaft runs in oilite bronze bearings.

**Pump only (Item #18) $14.95 postpaid**
**Mounting Kit only (Item #38) $4.95 postpaid**
**BOTH AS COMPLETE UNIT (ITEM #39) ..... $19.90 postpaid**

**ORDER DIRECT FROM AD**
**Send payment or purchase order today**

NOW . . . It's Easy to Weld with this handy

### ARC WELDER

250 AMP. MODEL 252

Designed for many years of trouble-free service. Handles any thing from light gauge sheet metal to ½" plate

(ITEM #65)

**FOR ANY WELDING JOB, LIGHT OR HEAVY**

This precision-engineered direct current ELECTRIC ARC WELDER is offered at but a fraction of its original value. It can be mounted permanently or easily transported for portable use. Does the job instantly, where and when you need it. The War Surplus generators for these Arc Welders were built by General Electric, Westinghouse, and Delco-Remy at a cost of over $300.00. They are light in weight; have oversized lifetime grease-sealed ball bearings; air-cooled commutator; dial type rheostat for easy pinpoint control; high-low range switch; reactor coil for even arc; handles 1/16 to ½" rods. Run welder at 2500 R.P.M. from drive pulley or power take-off of tractor, a 7½ H.P. electric motor or a 10 H.P. gas engine. Use two V-belts, or flat belt (on pulley). Continuous welding rating—200 amps.; intermittent rating—250 amps.; 0-30 volts. Now AT A FRACTION OF ITS VALUE. Price includes double V or flat belt pulley and instruction book. Ship. wt. 107 lbs. Only one or two jobs will pay for entire welder. F.O.B. Chicago **99.50**

**ACCESSORY KIT** including welding helmet, electrode holder, two 10 ft. cables with clamp, and 5 lbs. of assorted welding rods. (ITEM #66) F.O.B. Chicago **10.50**

**Remember, Satisfaction is Guaranteed**

### 115 Volt—60 Cycle A.C. LIGHT PLANT GENERATOR

(ITEM #67)

**Ideal For:** Home Lighting, Hunting Lodges, Stand-by Electricity. Running All AC Electrical Appliances including: Fans, Motors, Electric Razors, Refrigerators, incubators, etc. 750 Watts at 1800 RPM using 1½ HP gasoline engine. 0-150 Voltmeter with Regulator. 1" diameter shaft with keyway for direct or belt drive, carried in two bearings, one bronze and one ball-thrust bearing, and packed separately to prevent damage to generator or shaft while in transit. Protection for emergencies to operate oil burner, stoker, freezer, water pump, and lights. These units, built to exacting Signal Corps specifications, are the answer to your lighting needs. Shipping wt. 60 lbs. AN OUTSTANDING VALUE **59.50** F.O.B. Chicago

### LOGAN 4-Way Foot Operated AIR VALVE

Model 6520

**BRAND NEW.** For double-acting pneumatic devices, such as operating air vises, presses, air machinery of many types. Heavy cast construction. Threaded for ½" pipe. Dimensions of valve body 8½" L x 5¾" W x 7½" H. Net Wt. 28 lbs. Gov't acquisition cost $42.00. AN OUTSTANDING BUY AT (ITEM #59) F.O.B. Chicago **15.00**

**FREE: NEW 1950 CATALOG**

**GROBAN SUPPLY CO. Dept. PS-2**
**1507 S. MICHIGAN AVE., Chicago 5, Ill.**

### BRAND NEW HANNA AIR CYLINDER

Used for heavy duty industrial applications on shop air lines or with low pressure systems. With 100 lbs. of air pressure, will deliver 1900 lbs. pressure at the ram shaft. All steel construction. Adjustable cushions at both ends of cylinder. Shaft dia. 1½". Foot mounting with clevis on ram shaft. 26½" double-acting stroke; 5" bore, 40½" overall length closed, 7" overall width. 89½ lbs. net wt. Gov't. acq. cost $101.85.

(ITEM #61) AN EXCELLENT VALUE for **39.50** F.O.B. Chicago

### HALE FIRE and IRRIGATION HIGH VOLUME CENTRIFUGAL PUMP

**For Fire Protection, Irrigation, De-Watering, Industrial Uses, Farm Uses, Etc. PUMPS RATED 500 GALLONS PER MINUTE AT 275 FT. HEAD PRESSURE**

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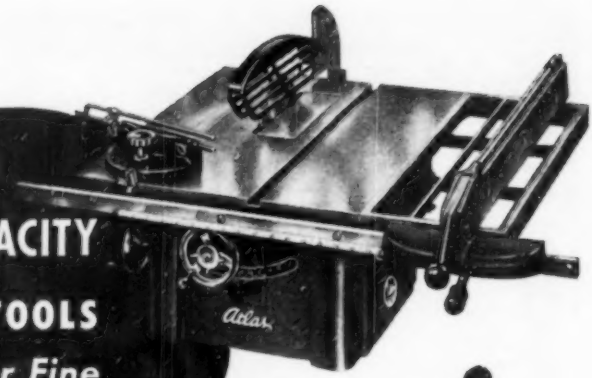

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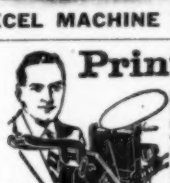


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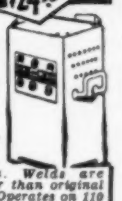

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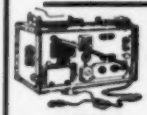

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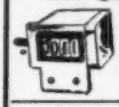

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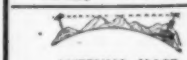

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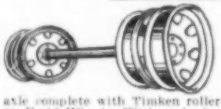

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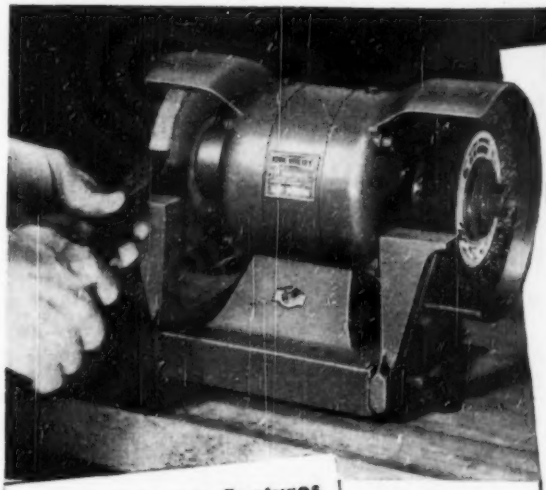

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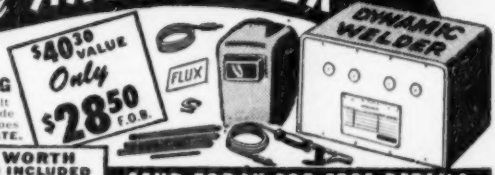


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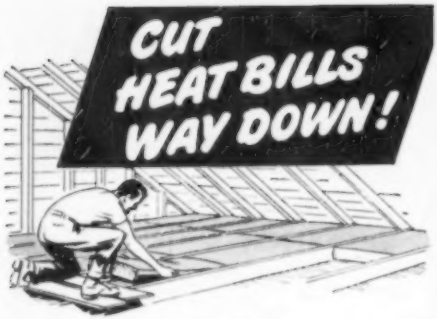


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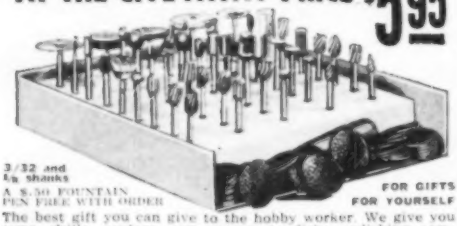

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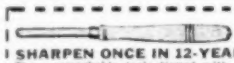
An ordinary roll of toilet paper makes an ideal element for any oil filter. Laboratory tests prove it cleans oil faster and better than popular makes of filter elements. With a simple set of adapter plates you can start using toilet paper . . . . instead of expensive replacement elements . . . . in your present oil filter. Easy to install yourself. For proof and descriptive literature, send name, address, make of car or truck and brand of filter. **Retlif Filter Corporation, Dept. PS-2 1237 No. Highland, Los Angeles, Calif.**



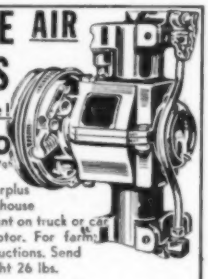
AMAZING NEW **WOOD-TURNING TOOLS**

**SHARPEN ONCE IN 12-YEARS! (UNDER NORMAL USE)**

These remarkable tools tipped with TUNGSTEN CARBIDE will astound you with their performance. They work FREE HAND equally well in wood, plastic or soft metals—and at the same time hold their razor-like edge almost indefinitely. Tests show that they will turn wood or plastic for days and days CONTINUOUSLY without showing any signs of dulling. They are the finest tools available at any price. Beautifully finished 5" blade—finish ground, polished tip—finest brass tube ferrule—9" hardwood handle—over all length 14"—25 tools to choose from: round and square nose from ⅛" to ½"—⅛" cut off; ½"x30° skew, spear, r. & l. skews, turning and parting. Amazingly Low Prices! Write at once for free literature.

**JOHNS MFG. CO., DUNELLEN 7, N. J.**

## WESTINGHOUSE AIR COMPRESSORS



Lowest-Ever Closeout Price!

WESTINGHOUSE Reg. $60.50 **18.50** FOB Pgh

Model T-1, brand new, complete—Surplus Special at amazing low price. Westinghouse Double-piston type, 6.54 volume. Mount on truck or car engine—or operate with ½ HP motor. For farm, home, industry and painters. Full Instructions. Send check or money order. Shipping weight 26 lbs.

We Carry a Full Line of Spare Parts

**NATIONAL STORES** 200 Smithfield St., Dept. 32 PITTSBURGH 22, PENNA.

# YOU CAN'T LOSE!

NATIONALLY ADVERTISED PRODUCTS

NO EXPERIENCE NECESSARY

NO MONEY TO INVEST

FREE SAMPLE OUTFITS

FULL OR PART TIME

## HAVE A PROFIT MAKING BUSINESS OF YOUR OWN

### A LIFETIME FUTURE

Man or woman—young or old, YOU can earn a steady income in full or spare time as an independent Kendex dealer. Amazing and almost "impossible" earnings can become a reality for you. Herbert Armstrong of Tenn. earned $202 in 9 days. C. O. Watkins of Oregon sent 92 orders in one day. You have the same opportunity to duplicate these exceptional earnings. Over one million dollars will be earned in 1950 by Kendex dealers—why not let us establish you in your own business and get a share of these wonderful earnings?

### KENDEX NYLONS REPLACED FREE . . .

if they run or snag within guarantee period up to three months! Impossible? It's true! No matter what the cause—hard use or deliberate abuse—whether it is fault of the hose or the wearer—Kendex nylons are replaced FREE if they run, snag or become unfit for wear within the guarantee period. How could any woman resist a positive guarantee of satisfaction when she can obtain it without paying any more than other standard advertised brands? Kendex nylons are NOT sold in stores, so you have no competition. Complete line includes everything from heavy 70 denier service weight to gossamer luxurious ultra sheer 15 denier 60 gauge. Proportioned sizes and lengths. Latest colors plus white.

### LINGERIE - ROBES - HOUSECOATS - MEN'S HOSE

In addition to the sensational Kendex nylons, you will have a complete line of glamorous lingerie, beautiful robes and housecoats plus a complete line of Kentcraft mens' hosiery guaranteed for one full year. Any pair or pairs of men's hose that does not give satisfactory wear within one year of purchase will be replaced FREE!

### NATIONALLY ADVERTISED

Kendex will spend over $350,000.00 in 1950 to tell millions of readers of the advantages in buying from you. Almost every issue of Good Housekeeping, Saturday Evening Post, McCall's, Women's Home Companion and Ladies' Home Journal carry our advertising in addition to many others. Kendex has advertised in Life, Look, Collier's, etc. Awarded Good Housekeeping Seal. Thousands of orders are shipped daily from coast to coast.

### FOUR MONEY-MAKING LINES

- WOMEN'S NYLON HOSIERY
- GLAMOROUS LINGERIE
- HOUSECOATS—ROBES
- MEN'S HOSIERY

MAIL TODAY

NOTHING TO PAY

NO OBLIGATION

FREE NYLON STOCKING

### EVERYTHING GIVEN FREE

Risk nothing! Mail coupon and we will send you, free and prepaid, complete money-making outfits including sample nylon stocking, samples of lingerie, robes, housecoats and men's hose fabrics and everything you need to immediately start making money. Complete outfits become your property even if you don't send any business. Simply write orders, we deliver and collect. Advance cash plus huge bonus. No money or experience needed. Mailing the coupon is all you need to start on the road to a 52-weeks-of-the-year high paying business of your own. You have everything to gain and nothing to lose.

**KENDEX COMPANY, BABYLON 649, N.Y.**

KENDEX COMPANY
BABYLON 649, N.Y.

Date _____ 1950

Send me, free and prepaid, everything I need to make money as a Kendex dealer, including sample stocking etc. There is nothing for me to pay now or later and I am under no obligation in accepting your money-making outfits.

Name _____

Address _____

City _____ State _____

NEW 5 lb., 37" CARBINES with HINGED FOREND

$21.95 MODEL #142 (Illustrated)
.22 cal. bolt action, 7-shot repeater.
$22.95 west of Rockies

$26.95 MODEL #152
.22 cal. 7-shot automatic.
$27.80 west of Rockies.

Scope extra $9.35

*Insist on a Mossberg, at your dealer's.*

FREE... Send for catalog with full story of Mossberg rifles, shotguns, scopes.
No sales at factory

O. F. Mossberg & SONS, INC.
9702 St. John St., New Haven 5, Conn.

Snap-on* MAGNETIC PICK-UP TOOLS
• Powerful Lift • Small Size
• Hinged Handles

Perfect for retrieving iron and steel objects, such as bolts, nuts, washers, cotter pins, etc., that fall into small places.

9" Size Lifts 8 oz. $1.00

16" Size Extends to 27" Lifts 24 oz. $1.95

DIRECT THRUST HACKSAW
One-piece steel tube back is fitted into a precision-machined cast-aluminum handle. With 10" blade . . . . $3.95

*T.M. REG. U. S. PAT. OFF.

SNAP-ON TOOLS CORPORATION
8060-B 28th Ave. Kenosha, Wisconsin

I enclose ☐ Check ☐ Money Order for the following tools:
Pick-up Tool ☐ 9", ☐ 16"
Hacksaw Frame, blade ☐
Add Local Sales Tax
Name.....
Address.....
City.....State.....

FOR FASTER WORK IN HOME OR SHOP...

HOLD-E-ZEE
The Original AUTOMATIC GRIP SCREWDRIVERS

Pat'd.

See these popular, high-quality drivers with the exclusive Gripper that holds, starts and sets up screws in unhandy places!

New Models FOR RECESSED HEAD SCREWS

At Leading Dealers Everywhere
UPSON BROS., INC., ROCHESTER 4, N. Y.

Amazing INSTANT GLOSS
Cleans—Waxes with One Application

for Autos, Trucks, Buses, All Painted Surfaces, Windows, Mirrors, Venetian Blinds, Ranges

Original all purpose dry cleaner. Just rub it on—let it dry—rub it off. Cleans and waxes—leaves a mirror-like gloss. Contains no grit or abrasive substance—will not harm the most delicate finish. Try it. You'll be amazed!

5-OZ. CAN ONLY $1

Enough to clean your car 6 times!

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USE YOUR BENCH SAW
FOR JOINTING & CUTTING MOULDINGS

With our six inch tool steel cutters make mouldings, casings, drop-leaf tables, grooves beading and jointing. Moulding cutters, A 1 in. wide $1.75, 1½ in. $2.25. Jointing cutters, B 1 in. $1.75, 1½ in. $2.25. E 1 in. for drop-leaf tables, $1.75. E 1½ in. Makes ¾ in. cove & Quarter, $2.25. Postpaid. Guaranteed. State size hole. List & Folder free.

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THE FRESNO HARDWARE COMPANY

Build your own SMITH Compressor
Operates spray guns, rock drills, tampers, paving breakers, sandblasting . . . Uses only 1 gallon of gas an hour!

Save Money—build your own Smith Air Compressor! Famous the world over! Capacity 60 cu. ft.; pressure up to 100 lbs. per sq. inch. Just order the Smith Compressor Head and Accessories with complete instructions for assembling. All you need is a Ford Motor and shop facilities. Head equipped with high speed compressor valves; automatic unloading and idling.

Write for complete information!
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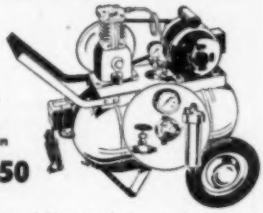
**Spray paint your home, car, garage, etc.**

**Complete Outfit Including Spray Gun**



$150 Value, only **$89.50**

Use also for spraying insecticides on plants and flowers. 1/3 H.P. heavy duty capacitor motor. AC 110/220 volt, 60 cycle. 2 x 1¾ inch piston type compressor, splash feed lubrication. 12 x 24 inch tank, automatic pressure switch. CFM 2.8 at 100 lbs. pressure, or 150 lbs. pressure for intermittent duty. Check valve, safety valve, air regulator with gauge and filter, spray gun with 20 ft. air hose and air chuck for inflating tires. V belt drive. Mounted on 2 wheels, ball bearing, with 2" x 10" pneumatic tires. Portable, with handle. Shipping wt. 90 lbs. Regular $150.00 value. ONE YEAR GUARANTEE.

**PARTS SOLD SEPARATELY**

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| Compressor | 17.50 | wt. | 16 lbs. |
| Automatic pressure switch | 7.50 | wt. | 3 lbs. |
| Regulator, gauge and filter | 8.50 | wt. | 5 lbs. |
| Spray gun | 9.95 | wt. | 4 lbs. |
| Tank, wheels and base | 17.50 | wt. | 32 lbs. |
| 20 ft. hose | 2.95 | wt. | 6 lbs. |
| 1/3 H.P. Cap. motor | 22.50 | wt. | 28 lbs. |
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The Rite-Way Mower Attachment ▶

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## POWER LAWN MOWER

**WHY PAY MORE FOR FACTORY BUILT MOWERS?**

Now anyone can save time and effort mowing field or lawn by building their own whirl type Power Mower. Build it in a short time with parts and instructions we furnish. Requires no special tools.

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Pumps 1800 GPH 300 gal. 30' high, uses ⅛ to ⅓ HP motor. Will not clog. **$6.50**

**Postpaid if cash with order.**
(Add 50c for west of the Mississippi.)

*Thousands in use since 1936*

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## of WAR SURPLUS
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*We Furnish Optics and Instructions*

- LENSES, PRISMS & RETICLES
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## LAFAYETTE'S NEW 164 PAGE CATALOG

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**Radio and TV Sets—Parts—Tools—Hi-Fi—Public Address—Kits—Test Equipment—Ham Gear—Record Changers—Records, etc.**

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*Lafayette* **famous FM-AM HIGH-FIDELITY CHASSIS** *with built-in* **PHONO PRE-AMPLIFIER**

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**INCLUDING WIDE RANGE 12" PM SPEAKER!**

Look at these $300 set features: Latest 11-tube circuit plus rectifier. 10 watts undistorted power output. Phono pre-amplifier permits direct connection of variable reluctance pick-ups. High and low impedance phono input. Tone control. Slide rule dial. Supplied with loop and folded dipole cabinet antenna. 12" PM speaker with Alnico V magnet. 105-125 volts, 60 cycles, AC only. Chassis dimensions: 13x9x9½. Shipping weight: 25 lbs. Complete with tubes $59.50.

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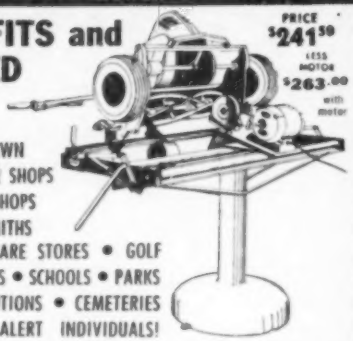
**PROFITS and SPEED**



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$263.00 with motor

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*Sharpens All Reel Type Mowers • Hand, Power or Gang • 10 to 20 Minutes • No Dismantling No Extra Attachments Needed*

All reel type mowers, from 5-inch edgers to 36-inch power mowers, are quickly sharpened to extreme ends of both left and right twist reel blades. Handle, wheels, roller and motor remain in place when sharpening is in process. Bed knife is sharpened in same brackets that hold mower in grinding position. No extra attachments required. One lever puts mower or bed knife in grinding position. 100% steel construction. Grinding head rides on five ball bearing races. Easy to operate. Sharpens wood chisels, joiner knives and planer blades without extra attachments.

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Extra flexible, corrosive resistant.

| Size | Strands | App. break lbs. | Per foot |
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| 3/32" | 7/7 | 920 | .04c |
| 1/8 | 7/19 | 2000 | .06c |
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AIRPLANE GENERATOR. P-1 type, 200 amps, 24V; use for welding, lighting, etc. Good used condition. FOB. Ship. weight app 600#. reduced to $15.

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(Not a "Vibrator")

PLUS ★ Power Sander PLUS ★ Filing Machine

3 in 1

ALL $11.95 POSTPAID INCLUDING MOTOR

Absolutely Safe. All ages. Special Blade Guard 6x4" Tilt Top. Rotates, too. Saw GUIDES Sanding Table Tilts 45° Power Filer Powerful Motor! Money back guarantee if not satisfied in 5 days.

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Get wonderful NEW precision **Saw—Sander—Filer!** Own a whole Workshop, power driven! 3600 RPM Electric Motor, A.C. Oilite bearings, ground and polished shaft. Heavy flywheel, 3/16 saw stroke. Cuts to center 16" circle, or rotate table for longer pieces. Saw arm may be removed and stiffer type blade used on larger work. Slide-guides **in table** . . . PRECISE, straight cuts all angles. **SPEED SANDER:** own 45° tilt table. **POWER FILE.** Attach regular files. Fine for precision **metal work.**

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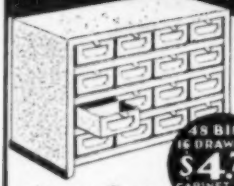

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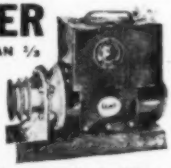

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WITH *Infinitely VARIABLE SPEEDS, Clutch and INSTANT REVERSE*

OUTPUT TORQUE ADJUSTMENT UP TO 180 inch POUNDS

This positive displacement Hydraulic Torque Converter is the ideal fluid drive with thousands of uses. Output Speeds Infinite 0 to 550 R.P.M. in either direction. Change Speeds WHILE RUNNING. Control and Transmit your power this SMOOTH Oil-Way. Will handle ¼ H.P. to 1½ H.P. Motor. Industrial or Home & Farm Use. Cost Government $300. High Quality Precision Workmanship. Buy this unit to get the most for your money. Case measures 7½" long 7" high 6½" wide. Input & Output Shafts ⅝" dia. Beautiful Red Crackle Finish Case.

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*Shipping Wght. 25 pounds*

Only $54.50 PREPAID
2 quarts oil included FREE

If C.O.D. is requested a 20% Deposit must accompany order and we ship F.O.B. Chicago.

1½"-8 thread Lathe Chuck Adapter, $3 extra

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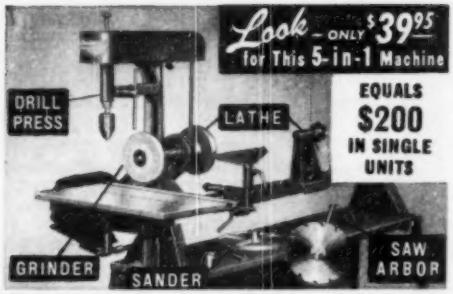


**Become an expert craftsman. Operate profitable business at home. Save money on household repairs. Lifetime pleasure for entire family at few cents per hour, making things from wood, metals, plastics.**

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EMRICK is 5 precision power tools in ONE assembly, using ONE Motor. Equals in performance separate units costing up to $200—**yet our price only $39.95 for everything identified above.** Thousands of satisfied customers. Our 52nd year building fine tools.

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In your own workshop allows you to design and build your own GASOLINE ENGINES, STEAM ENGINES, STATUARY, ART OBJECTS, SPECIAL TOOLS, NEW INVENTIONS, ETC. You can also make forgings and case harden steel. Your shop is not complete without a FOUNDRYETTE. Three sizes are available capable of making bronze castings of 1½, 3 and 6 pounds weight, aluminum, copper, brass, etc., $22.50, $29.50, $42.00 f.o.b. Kansas City. Domestic gas supply and 110 volt AC or DC energy required for operation. Write for circular.

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PERMANENTLY mends cracks or holes in wood, tile, stone or plaster. Sticks and stays put—Does not chip, shrink or fall out. Easy to use. Economical. Mold it, chisel it, polish or paint it. If unobtainable from your lumber, paint or hardware dealer, the big 4-lb. can will be sent you postpaid (in U.S.) for only $1. Full money-back guarantee, order now.

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Genuine Air Force Issue! The Air Corp's finest jacket. Top grade leathers, trimmed at cuff and waist. Ex. lge. sheepline collar. Adj. tabs at side, zip front. Reconditioned. $42.50 value. Mod. sizes only. $15.95 New: $21.95

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Rubber sole, sheepline for warmth. Zipper closure. Used. Est. $18.50 $6.95 Brand New $9.95 ALL SIZES

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NEW. Mummy style. Filled with mixture of down and chicken feathers. Water repellent poplin cover. Zipper opening. 12.99

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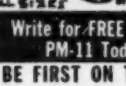
Finest 100% wool blankets issued! Soft, soil resistant nap. Olive drab, cleaned, guaranteed perfect. This quality in civilian colors sells for $12.50 Wgt. 4 lbs. $3.88




**BRAND NEW O. D. ARMY BLANKETS**
Right out of orig. govt. cases. Size 68"x86". 4 lbs. $5.88 2 for 11.50

**TYPE B-3A FLYING GLOVE**
New, fine supple brown leather. Separate rayon liner for extra warmth. Both complete. 2.69

**B-3 High Altitude FLYING GLOVES**
New, soft durable brown leather. 100% wool lined liners. Sizes 8-9-10-11 $6.00 value $3.88

**Sportsmen's BRAND NEW! N-1 PANTS** —100% Wool-lined, water-repellent jungle cloth! Rugged and warm! Sm., Med., Lge. sizes. 4.98

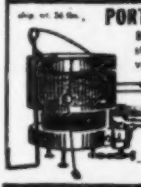
**A-9 FLYING GLOVES**
$10.00 wouldn't buy a better mitt. Warm, fleecelined, soft deerskin. New! Large only. $4.98

**AIR FORCE FLYING TROUSERS**
LEATHER • SHEEP LINED! Brand New! The Navy's finest! Zippers entire length of pant. Suspenders included. All sizes. Government cost over $20.00. State waist size and length. $6.88

Mail orders add 10% for packing and shipping. Send deposit or check with order. Every item guaranteed as advertised.

**AAF ALPACA LINED PANTS**
ALPACA LINED THRU-OUT! Weatherproof poplin outer. Complete with pockets, zippers and suspenders. Warm, light weight. State waist size. $5.88

**PORTABLE GASOLINE HEATER**
Brand new. Complete with 3 gal. steel tank. Automatic float valve prevents flooding. Famous Evans blue flame burner produces 30,000 BTUs per hr. Flexible steel fuel line. Durably made for U. S. Air Force! Excellent for tents, barns, hangers, garages, etc. $50 value. No. 58 $12.95 ship. wgt. 36 lbs., ship. exp. col.



**FISLER SALES CO.** 723 Walnut St. Kansas City 6, Mo.

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## FIRE EXTINGUISHERS

New Surplus 1 gal. capacity fully charged, ready to use. Carbon-tetrachloride is non-conductor; stored pressure type shoots 40 foot stream; height 23", diameter 5". Ideal for home, garage, workshop, etc. Lists approx. $65.00. Our price. $14.95

*Price F.O.B., Kansas City, Mo. No C.O.D.'s*
Send 10c For New 72 Page Jam Packed Catalog

**ATLAS EQUIPMENT CO.**
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# UP TO 80% SAVINGS ON WAR SURPLUS

**LT. WT. ALUMINUM PIANO HINGE**

Length 72 inches, thickness .040—width 1¼"— Operating radius 275 degrees. Made of aluminum alloy, sold in 6 feet lengths only— per length.... $1.14

**HEAVY DUTY STEEL PIANO HINGE**

Length 56"—Thickness 3/32"—Width (open) 3-5/16"—Operating radius 330 degrees—Made of heavy duty steel—Drilled ready for use. Ideal for drop tables, heavy tool boxes, heavy doors, and many other uses where heavy hinges are required. Sold in 56" lengths only. Ship. Wt. 7 lbs. At a fraction of original cost $1.45

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Made in accordance with rigid army specification. Clean fresh stock. ⅝" contains approx. 500 strands of live rubber. ⅜" approx. 100 strands. ¼" approx. 40 strands. Sold in 25 ft. lengths or more. At about 20% of original cost.

| DIA. | PRICE (per 25') | Ship. Wt. |
|---|---|---|
| ¼" | $1.00 | 2 lbs. |
| ⅜" | $1.25 | 2 lbs. |
| ⅝" | $1.75 | 3 lbs. |

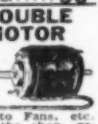
**HEATING ELEMENTS**

For home made photo print dryers, chicken brooders, etc. Wiring diagram for use on 110-volt 50 watts each. Each element 11½"x2½"x3/16". Set of four..... 96¢

**OIL IMMERSION HEATER**

110 volts AC or DC. Three position. High Heat (1250 watts). Medium Heat (625 watts). Low Heat (312 watts). Make winter starting on your car, truck, tractor, or farm equipment, easy. Just plug in your 110V Immersion Heater, insert it into your oil tank through the oil filler hole, and have hot oil in a jiffy. Heating elements 11" long, diameter 1¾". At a fraction of original cost. Each $7.55

**6 VOLT DOUBLE SHAFT MOTOR**



1/30 horse-power motor made by Delco. This is a 6 volt D.C. motor with two ¼" shafts, used on Auto Heaters, Auto Fans, etc. Ideal for use in the shop, garage, and wherever 6 volt D.C. is available. RPM 3700. Ship. wt. 3 lbs. List price is $4.20, our price is a real money saving buy. Our price, only $2.95

Prices F.O.B. Chicago. Include approx. postage on orders paid for in advance. C.O.D. orders enclose 25%, balance sent C.O.D. WRITE FOR FREE ILLUSTRATED CIRCULAR.

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**Over 65,000 Sold—It Must Be Good!**

Genuine Carborundum wheel ideal for shop or home use. Send remittance with order and shipment will be made at once, prepaid to your door complete with electrical goods catalogue.

Motor driven $9.75 complete with vise

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**VEST POCKET SIZE**

**IDEAL FOR INCOME TAX!**

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Fits vest pocket or purse. Guaranteed accurate. Operated as easily, and as reliable, as machines costing many times as much. Not a toy. **Precision made, very durable—guaranteed for life against defects in construction.** You positively can't buy a calculator of equal quality for as little money. **ACCEPTED AS THE FINEST LOW PRICED CALCULATOR FOR OVER 35 YEARS!** Operates with a flick of your finger. Adds, subtracts, multiplies, divides—counts up to one billion. Pays for itself over and over in mistakes avoided, and time saved.

**FREE!! Each Baby Calculator in Beautiful, rich-looking Leatherette case—at no extra cost.**

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Sold on a positive money back guarantee. Send only $2.95. Calculator sent postpaid, or send name and address and pay postman $2.95 plus postage. **MONEY BACK IN 10 DAYS IF NOT DELIGHTED!** (If outside U. S., send $3.50.)

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ONLY $17.00 PER SET

**Remake Old, Loose, Cracked or Chipped Plates Into Perfect Fitting Natural Beauty-Pink Dupont PLASTIC PLATES**

**NEW METHOD—NO IMPRESSION NEEDED**

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Only $11.75 complete

***$8 EXTRA PROFITS! $8***

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● Thousands of uses in Home, Shop, Industry: Makes Auto Interiors Clean & New. Lines drawers. Waterproofs lamp bases. Refinishes any object. All in colorful Flock. Etch & Frost windows, glassware, etc. Removes Paint & Rust from Autos, Tools. Guaranteed! Send $19.75 or write for free information. **Complete Flocking Supplies!**

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| 5" Disc Wheel ⅝" Tire 5/16" or ⅜" sleeve | 30c ea. |
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| 7" Disc Wheel ¾" Tire ⅜" sleeve | 45c ea. |
| 8" Disc Wheel 1¼" Tire ½" sleeve | 70c ea. |
| 7" Disc Wheel 1" Tire ½" ball bearing | 80c ea. |
| 8" Disc Wheel 1¼" Tire ½" ball bearing | $1.00 ea. |
| 8" Disc Wheel 2" semi-pneum. T. ½" B.B. | $1.35 ea. |
| 10" Disc Wheel 1.75 semi-pneum. T. ½" B.B. | $1.50 ea. |

Above wheel prices include hub cap.

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|---|---|
| 10" Aluminum Wheel 2¾" semi-pneum. T. ½" B.B. | $4.50 ea. |

Plus Postage, 20% — C.O.D.'s accepted.

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***Puts light where You need it!***

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#4 with rubber grip spring clamp . . . . . $2.35

#42 with 2-section telescopic steel stand, plated. Elevates to 6'6" . . . . . $4.95

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**$36***

6x30 Achromatic Field Glasses **$16***

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• Lubricates

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***Takes less than 3 hours***

The Handy-Dandy Lawn Mower Kit fits any hand mower from the 16 to the 20 inch size. Complete with all necessary parts. Kits can be purchased separately, complete with engines or complete with Pennsylvania mower.

Also manufacturers of a complete power mower and garden cultivator attachments.

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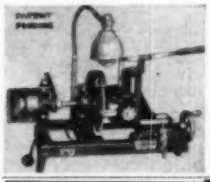

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Model No. 37-510
$89.20
motor and switch rod extra
Price subject to change without notice

*Low down payment delivers!*

## *Saves space! Saves money!*

## Delta® Homecraft Saw-Jointer Combination

Two precision-built tools on a single stand, using one motor. Takes floor space of only 25¼" x 28¼". Husky 8" tilting-table saw cuts stock up to 2¼" thick. Rip to center of 15" panel, cross-cut, angle-saw, bevel-saw, dado and make mouldings. Jointer planes up to 4" wide, rabbets ¼" deep. Fence tilts 45° to right or left. See your Delta Homecraft dealer today!

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"How to Start Your Home Workshop." Write for your copy today.

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## U. S. NAVY SURPLUS—ACCURACY—PRECISION—GUARANTEED

For PRECISION timing of all rotating mechanisms. Incomparable GUARANTEED ACCURACY of 1/10 of 1%. An RPM counter and surface speed indicator combined with chronometric operation which AUTOMATICALLY computes period of test in EXACTLY 6 SECONDS. No stop watch or personal equation necessary. UNSURPASSED for cameras, projectors, generators, motors, sanders, turbines, saws, shafts, looms, fans, lathes, etc. Packed in plush-lined, simulated leather case. UNCONDITIONALLY GUARANTEED subject to your inspection and approval. Manufactured by JAEGER and TOTCO, leaders in field of exacting measuring devices. Only $19.75 Shipped postpaid in U.S.A. on cash orders.

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No batteries needed. Your voice generates current. O.K. for 25 miles. Perfect intercom for shop, office, farm, darkroom. WAR SURPLUS. Orig. Govt. Cost $58.00 ea.

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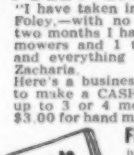
## this quick way

with

## FOLEY LAWN MOWER SHARPENER

"I have taken in 100 mowers in 5 weeks since I got my Foley,—with no advertising," says George C. Wise. "In two months I have sharpened 155 hand mowers, 6 power mowers and 1 trimmer. My machine has paid for itself and everything I take in now is all profit"—from Otis Zacharia.

Here's a business you can start in spare time, and begin to make a CASH PROFIT right away. The Foley handles up to 3 or 4 mowers per hour, and prices run $1.50 to $3.00 for hand mowers, $5.00 to $8.00 for power mowers.




**FREE BOOK—** "HOW TO SHARPEN POWER MOWERS" shows just how to sharpen any make of power lawn mower with the Foley. Low prices, only $98.50 to $139.50—easy payments. Mail coupon today—we'll also send FREE PLAN telling how to start your own business without previous experience. No salesman will call.

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Send FREE BOOK "How to Sharpen Power Mowers," and FREE PLAN on lawn mower business.

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**$500,000.00 INVENTORY for QUICK LIQUIDATION**

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1. With Highspeed TIMKEN BEARING (with Grease Retainer) $8.95
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*Freight Collect* (8½ lb.)

Ideal for Handcarts, Bogies, Trailers, Soapbox Racers, etc. A bargain from the world's largest stock of all types of Airplane Tires. Send your check or money order to:

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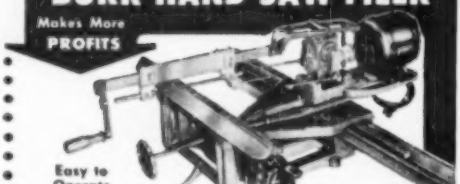
Makes More PROFITS



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Fast, accurate, will file from both sides. Operator controls file arm. No saw carrier or adjusting screws to fuss with. A money-maker in any shop.

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Wear when sanding, grinding, paint spraying, sweeping, dusting, furnace cleaning, etc. Handy as a pair of glasses. Just keep mouth closed and breathe through nose is all you do to operate. Protects against dusts, lint, coal, cement, grain dust. Has 9 sq. in. filter. Order today.

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**STEEL HOUSING (Not Die-Cast) BALL BEARING**

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**NEW DEPARTURE SELF-LUBRICATING BEARINGS!**

Mount & Put To Work!

A-S1—Plain Spindle . . . . . $3.75 pp.
A-52—⅝x4½ spindle . . . . . $5.25 pp.
A-61—½x12½ spindle, housing 2x8 $7.75 pp.
A-62—⅝x12½ spindle, housing 2x8 $8.25 pp.
A-63—¾x12½ spindle, housing 2¼x8 $9.00 pp.
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10,000 r.p.m. 1" BETWEEN WASHER & COLLAR
Enclose check or m.o., Satisfaction Guaranteed!

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- 1 Precision key machine complete with three cutters.
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### BRAND NEW ARMY AIR FORCE
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New B-29 navigation instrument which can easily be used to make a good contact printer, strip map holder, etc. The plywood case 14½" x 11" x 10" high is perfect as tool kit, camera projector case or for building a portable phonograph, picnic kit, makeup case, etc. Has leather handle, reinforced cover, eight covered compartments in bottom. Cost Gov't $125.00. Add postage for 20 lbs.

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Use on car, boat, dark rooms, workshop, airplanes, etc. Turn of knob gives clear, white, or red light, also pulls out 6 ft. on spring wound internal reel. Quick snap automatically rewinds wire. Fluorescent tipped on-off switch. Takes standard automobile bulb — mounts anywhere. 3" x 3¼" x 4½". $12.50 value only. FOB B. H. ..... **$2.50**

### LIGHT PLANTS

110 volts — 250 watts — Complete Compact Gasoline Self-Contained Generating Set, perfect for camping, trailers, hunting, emergency home power, etc., self-governing output — two outlets for plugging in lights — Brand New — in factory sealed waterproof crates — single cylinder gas engine directly coupled to air cooled generator — rubber shock mounted, complete with spares, tool kit, and carrying case — weight 72 lbs. Measures 22" high x 16" wide x 20" long. FOB B. H. ..... **$89.50**

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For milk coolers, brooders, orchard use, refrigerators, automobiles, homes, workshops, etc. Temperature bulb at end of either 5 or 15 ft. flexible tube (state length desired). Dial Thermometer glows in dark — non-electric — very sensitive. Aircraft quality. FOB B. H. — worth many times ..... **$3.50**

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Perfect for car, boat, den, or workshop. Fine present for sportsman. Horizontally mounted, large 6½" dial — marked in single degrees. Fluorescent Dial glows in dark — dial rotates for positioning — compensated aperiodic and vibration resistant, $45.00 value. FOB B. H. ..... **$10.00**

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500 cu. in. capacity Steel Tank, can be used for compressed air, oil, gasoline, buoys, emergency air for tires, etc. 5½" x 23", up to 450 lb. pressure — non-shatterable — ¼" pipe fitting on each end. FOB B. H. ..... **$4.50**

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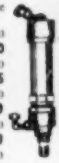

These "Brand New" Double Action, Precision Hydraulic Cylinders have 1000's of applications for use on lifts, presses, actuators, positioners, etc. Use with either air or oil. All use standard pipe fittings.

Item A — 1" Bore, 1½" Stroke — will lift 770 lbs. using 1,000 lb. pressure. A $18.65 value — Postpaid ..... **$4.50**

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Item C — 1¾" Bore, 8½" Stroke—will lift 2,400 lbs. at 1,000 lb. pressure. A $55.00 value — Postpaid ..... **$12.50**

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Item E — 3" Bore, 10" Stroke — will lift 7,000 lbs. at 1,000 lb. pressure. An $85.00 value — Postpaid ..... **$20.00**

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Modernize your car. Fine for desk ornament. Shows height above sea level up to 20,000 feet while driving your car, same instrument as used in airplanes. Front adjustment knob sets instrument for your location. Fluorescent Dial glows at night — easily installed — no connections — self-contained — Measures 3½" x 3½" x 3". Certified calibration chart included — suitable as a laboratory standard instrument. Cost Gov't many times this price. FOB B.H. ..... **$3.50**

Enclose sufficient postage — Excess will be refunded — No COD's

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## 5 BIG POWER TOOLS in ONE

RETAIL PRICE $125.00

**FACTORY TO YOU $59.95**

**SUPERSHOP** the PRECISION BUILT WORKSHOP. Lifetime lubricated **BALL BEARINGS.** All running parts precision **GROUND.** Compare finest production tools. **BIG** capacity. Amazing **VALUE. Write for FREE catalog, full details, trial plan.**

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**100 Pieces $1.00** Post Paid in U.S.A.

FOR ELECTRIC GRINDERS

Grinding Wheels, Cut-off Wheels, Sanding Discs, Mounted Stones, Sharpening and Honing Stones, Rotary Cutting Burs, Abrasive Cartridges, and many other items. Rush check or Money Order.

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ON 2 MANDRELS— ALL AT ONE LOW PRICE

1" diameter saws on ⅛" Mandrels. For cutting wood, plastic, or soft metals. Order at once! Send Check or Money Order for this big bargain.

**$1.50** Post Paid in U.S.A.

### 18 ROTARY CUTTERS

$13.50 Value **$5.85** Post Paid in U.S.A.

Assorted sizes cutter on ⅛" or 3/32" shank. Will fit all hand grinders. Ideal for cutting wood, metal, or plastic. Brand new.

Send Check or Money Order. ILLUSTRATED BARGAIN CATALOG 10¢
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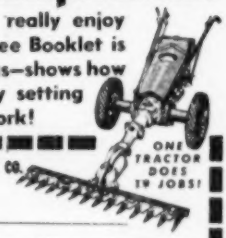
**FREE!**

Give yourself the leisure to really enjoy country living! This big Free Booklet is chock full of labor-saving ideas—shows how to give your home a lovely setting without long hours, hard work!

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REEVES Army Twill is a double duty fabric that's right for work and play. It's highly resistant to wear and tear, and its wide variety of vat dyed colors are fast to sun, water and perspiration. Being Sanforized*, it can take repeated washings and still come up fresh and new. For better looks and longer wear—demand Reeves Army Twill.

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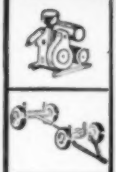

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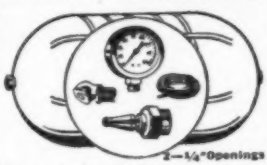


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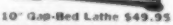

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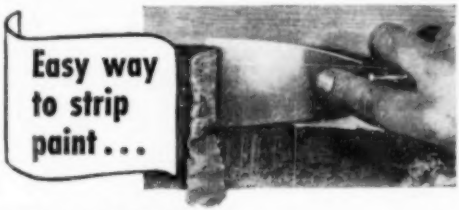

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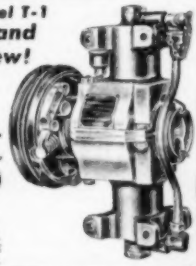

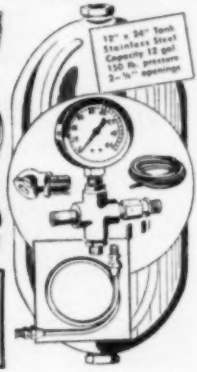


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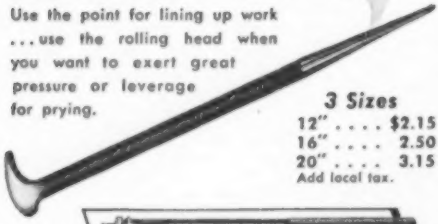

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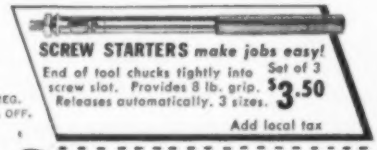

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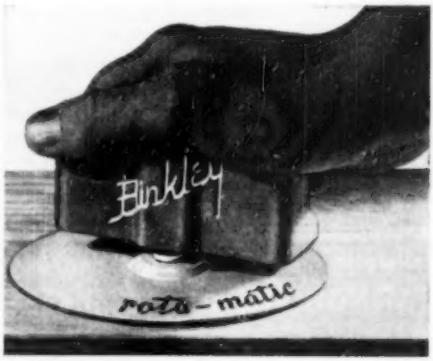
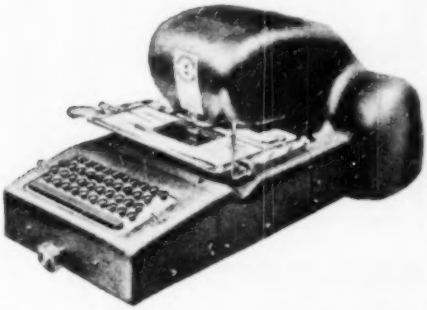
# New

**Tool Reduces Drill Speed.** With Grip-Torc® attached, any ¼" drill becomes a multi-purpose tool for heavy-duty boring, drilling, reaming, and other jobs. The geared mechanism increases torque output about 5-to-1. Grip-Torc is controlled by gripping or releasing the body of the unit, starting or stopping the working tool while the drill motor continues to run. McLaughlin & Co., Los Angeles, prices it at about $15.




**Hand Sander Rotates.** The pivoted disk of the Rota-Matic® sander is free to rotate at random as you push the tool back and forth. This motion brings into use all facets of the sanding grit. Interchangeable sanding disks—fine, medium, and coarse—are included with the sander, priced at $2.50 by the Binkley Manufacturing Company, Warrenton, Mo. The disks come with an adhesive coating on them.

# Tools



**Typewriter Marks Metals.** Designed for pressing markings into metal, this electric typewriter can be adjusted to letter wood, leather, or plastics. The interchangeable letter wheels—for various type sizes—are made of tool steel. To operate it, all you do is punch the keys. The machine can be set up to letter unhardened steel ½" thick. It's distributed by the Cadillac Stamp Company, of Detroit.

**3-hp. Saw Weighs 25 lb.** The one-cylinder, two-cycle, air-cooled gasoline engine that powers this saw operates in all positions. The tool is available in two straight-bladed models—18" and 24"—and as a 14" bow saw. The throttle is controlled by a trigger in the pistol-grip handle. A manually operated chain oiler is controlled by a button above the throttle. McCulloch Motors Corp., Los Angeles, is the maker.


*Your Hands are Handier with*

**SKIL Home Shop Tools**

**SKIL Home Shop Sander-Polisher**

IT DRILLS! IT SANDS! IT BUFFS! IT GRINDS! IT CLEANS!

Most useful tool you'll ever own! Powerful motor speeds a thousand jobs in your basement, garage or home. Drills, sands, buffs, polishes . . . wood, metals, plastics. With other attachments does wire brushing, stirs paint, grinds, sharpens. Takes out the work, puts in quality on every job.

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**SKIL Home Shop Saw**

Sawing is a cinch with powerful 6 in. SKIL Home Shop Saw . . . very low-priced but fully adjustable for depth of cut and bevel-cutting!

Plugs in anywhere. Rips, cross-cuts, miters 2 in. dressed lumber *10 times faster, easier* than by hand. Light, safe, easy-to-use on wood, metals, plastics. Ask to see SKIL Home Shop Saw *today.*

See the complete SKIL Home Shop Line!
- DRILLS—¼ in. and ½ in.
- BELT SANDER
- HEDGE TRIMMER
- Bench Drill Stands
- Drill Kits • Saw Tables

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SHAW DU-ALL and "PEPPY PAL" GARDEN TRACTORS

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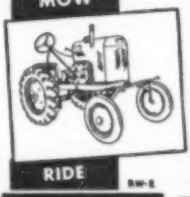

RIDE

These sturdy walking and riding tractors ideal for dozens of uses around the farm, orchard, garden, golf course, estate and poultry farm.

**DO DOZENS OF JOBS**
Shaw Du-All or Peppy-Pal tractors do many jobs quickly and easily. Plow, cultivate, harrow, mow, disk, bulldoze, spray, grind, haul and saw wood. New uses discovered every day.

**BUILT FOR RUGGED WORK**
Sturdy, extra-strength construction means low upkeep, long life. Patented tool control allows quick shift for crooked rows. Attachments easy to change with new "Jiffy Hitch."

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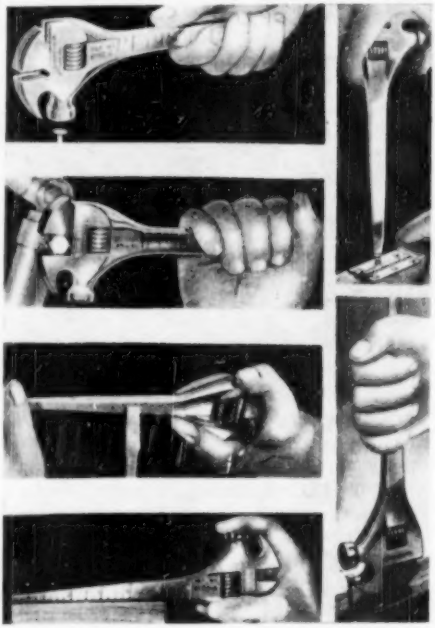
Send Cash, Check or M. O. for Prepaid shipment

**ALADDIN TOOL COMPANY**

3121 Main Street Kansas City, Missouri

*Dealers write for new 1950 catalog*

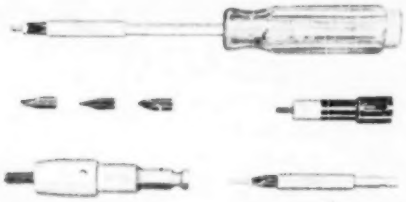
# New Tools



**Tool Handles Six Jobs.** Made in England and distributed in the United States by the Laster Export-Import Co., New York City, the Utilex® combines six everyday tools in one. It'll serve as a hammer, ¾" adjustable wrench, file, 6" rule, screwdriver, and a claw for pulling nails. It's priced at about $5. The Utilex is manufactured from forge-hardened steel.

**Improved Plier-Wrench.** The Snap-Lock® plier wrench, manufactured by Seymour Smith & Son, Inc., of Oakville, Conn., has a finger-tip control that releases the jaws. A capacity indicator on the handle shows the extent of the jaw spread so the tool can be pre-set. The tool serves as pliers, clamp, or vise. With work locked in the jaws, the tool can be clamped in a vise.

**Drives Nails Automatically.** From 40 to 50 nails a minute can be driven with the Azor Portable Pneumatic Nailing Tool, made by Azor Products Co., Los Angeles. The machine weighs about 30 lb., has a hopper capacity of from 400 to 600 nails, and handles 8d, 10d, and 12d nails. Nails may be driven vertically or at an angle. The nail set can be adjusted for depth, and the tool automatically stops driving at the predetermined depth. In a test, the Azor nailed 100 lineal feet of joists in eight minutes.



**New Magnetic Screwdrivers.** Magnetic pull has been stepped up 10 times in these power and hand screwdrivers made by the Magna-Tool Corporation, of Buffalo, N. Y. The power-driven tools include magnetic "finders" that pick up and automatically position the screw. Finders are available for various sizes of flat-head, round-head, oval-head, and fillister-head screws. The hand screwdrivers are furnished with a handle compartment for holding an assortment of bits for different screws.


# BUILD YOUR OWN POWER TOOLS

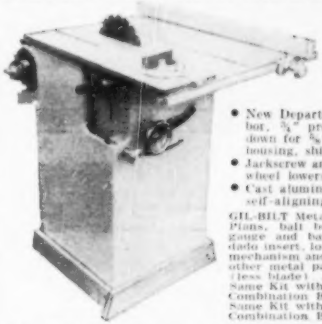
**EASILY, QUICKLY... AT LOW COST**

**SAVE $50 OR MORE**

**Exclusive GIL-BILT Build-It-Yourself Features**

- No machining—build easily with hand tools only
- No blueprint reading — step-by-step pictorial plans, full scale patterns, actual photographs
- Sturdy wood, aluminum, and steel construction
- Capacity and performance of commercial saws selling for $60 and up

## GIL-BILT 10-INCH TILTING ARBOR SAW



- 27x28 in. table, 13½ in. capacity in front of blade
- 10 in. blade cuts 3¼ in. deep, tilts full 45 degrees
- Floor model 34" high table always stays level
- New Departure ball bearing arbor, ¾" precision shaft turned down for ⅝" bore blades, alum. housing, shipped ready to run
- Jackscrew and 4½ in. dia. handwheel lowers and raises blade
- Cast aluminum miter gauge and self-aligning rip fence guide

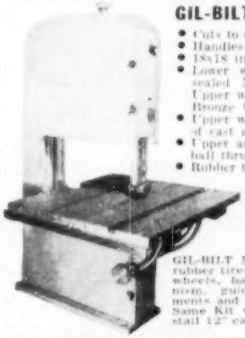
GIL-BILT Metal Parts Kit includes Plans, ball bearing arbor, miter gauge and bar, rip fence guide, dado insert, lock knobs, jack screw mechanism and handwheel, and all other metal parts (less blade) ..... **$20.95**
Same Kit with 10" Combination Blade.... **$24.90**
Same Kit with 8" Combination Blade.... **$23.90**

## GIL-BILT 8-INCH TILTING TABLE SAW

- 21x27 in. table tilts full 45 degrees, 13 in. capacity in front of blade
- 8 in. blade cuts from 0 to 2½ in.
- New Departure ball bearing arbor, ¾" precision shaft turned down for ½" bore blades, alum. housing, ready to run
- Cast aluminum miter gauge and self-align. rip fence guide (same as above)

GIL-BILT Metal Parts Kit includes Plans, Ball Bearing Arbor, Miter Gauge and Bar, Rip Fence Guide, Machined Lock Knobs, Tilt Support Segments, and All Other Metal Parts (less blade) **$15.95**
Same Kit with 8" combination blade..... **$18.90**

## GIL-BILT 12-INCH BAND SAW



- Cuts to center of 24 inch circle
- Handles stock up to 6 inch thick
- 18x18 inch table tilts 45 degrees
- Lower wheel and drive pulley runs on sealed New Departure Ball Bearings; Upper wheel runs on two ⅝" bore Oilite Bronze bearings.
- Upper wheel tension and tilt mechanism of cast aluminum, completely assembled.
- Upper and lower blade guides. Each has ball thrust bearing, self-lub bronze jaws.
- Rubber tired wheels. Choice of cast aluminum or make-your-own wood wheels on metal hubs.
- Uses standard 78 inch blades up to ⅝ inch wide.
- Fully enclosed mechanism for utmost safety.

GIL-BILT Metal Parts Kit includes Plans, rubber tires, ¼ inch blade, hubs for wood wheels, ball bearing spindle, tilt mechanism, guides, table tilt segments and all other metal parts **$16.95**
Same Kit with two machined ready-to-install 12" cast aluminum wheels **$20.95**

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Return in 10 days for full refund if not satisfied. Prices include postage within 600 miles. Over 600 miles add 5%. Send cash, check, or money order for parts kit, or send $1.00 for Step-by-Step Plans and order kit later less cost of Plans. Plans sent postpaid anywhere in the world.

**COMPLETE PLANS only $1.00 EACH**

# GILLIOM POWER TOOLS

**P. O. Box 1-VB, Lambert Field, St. Louis 21, Missouri**

# P.S. Last minute news & notes...

STEAM-DRIVEN CARS are being talked-up again in England—now that financial difficulties have forced Britain to curtail importation of gasoline.

LIGHT ALLOYS instead of steel save three tons in the weight of a Navy motor grader that can travel by air. Built-in boxes carry ballast, if necessary, to hold it down at work. An 80-hp. Diesel drives all six wheels.

RADIOISOTOPES produced by U.S. Atomic Energy Commission are being used now in more than 300 universities, hospitals and research laboratories.

"I FLEW BLIND on One Instrument," a PS story last February (p. 143), won for its author, Associate Editor Herbert O. Johansen, one of TWA's Twelfth Annual Aviation Writing Awards. The award included a flying trip from New York to Phoenix, Ariz.

COMMUNICATIONS equipment now being tried out by the Air Force sends printed messages, including maps, from ground stations to planes in flight.

OF 30 INSECTICIDES, tested by U.S. Public Health Service against adult house flies, best results were shown by a new chemical called Compound 497. Health hazards to sprayers using it are being studied by the scientists now.

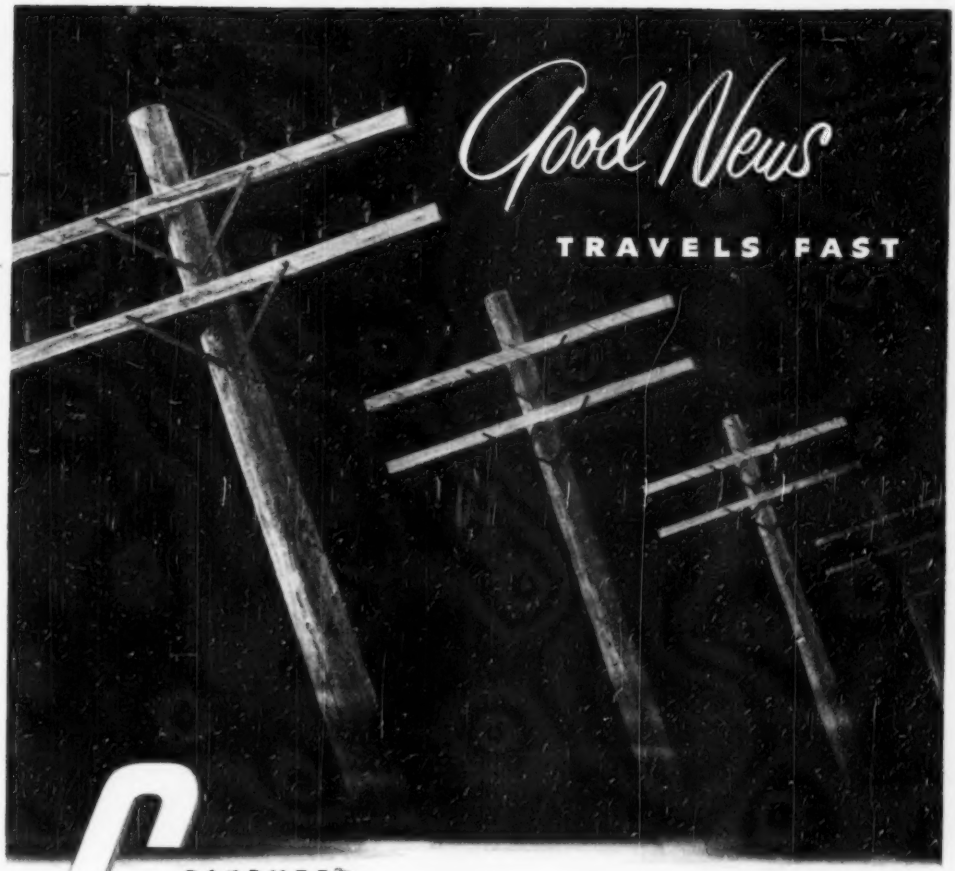
A DUST TUNNEL established by the Fram Corp. at Dexter, Mich., may help keep your future car engine cleaner, make it last longer. One objective of the Fram research: to find what filtering elements do the best job in keeping dirt and dust out of the air, oil, and gas an engine uses.

COAL RIDES 10,900 feet - more than two miles - on a new rubber belt near Morgantown, W. Va., which Goodyear reports is the world's longest single conveyor belt.

WESTERN UNION has developed a new kind of paper for facsimile telegraphy. It has a light grey coating of material that turns black when electric current from a wire stylus passes through it.

HOMOGENOUS MEAT, de-boned and minus fat, accompanied by recipes that give frequency setting and time for cooking on a table-side dielectric stove, is among electronic developments now forecast by Westinghouse expert Walter C. Evans.

*The Editors*




# PATENTED CORALOX INSULATOR

Pleased motorists everywhere are telling their neighbors the good news about *CORALOX*—how it removes the major causes of spark plug troubles in car, truck and tractor engines.

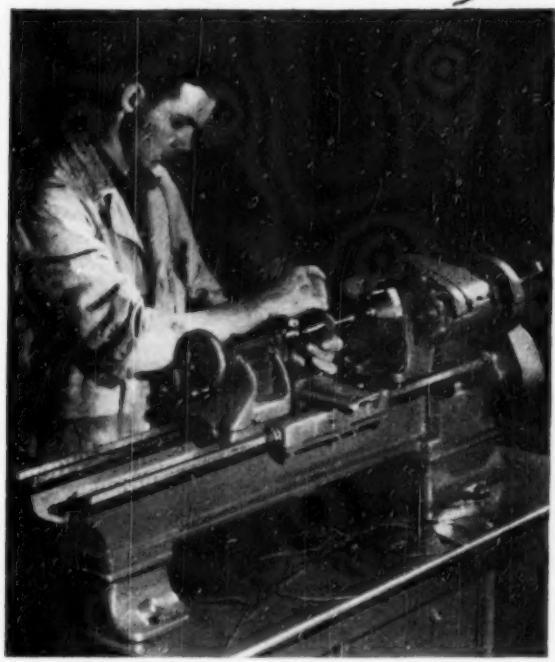
*CORALOX* is AC's patented Insulator. As compared with the best previous insulators, *CORALOX* is 3 times as strong—has 4 times greater heat conductivity—10 times greater electrical resistance at high temperatures—no affinity for oxide coating.

AC Spark Plugs, with *CORALOX* Insulator, will fire better and last longer in *your* engine.

AC SPARK PLUGS

AC SPARK PLUG DIVISION • GENERAL MOTORS CORPORATION

# Why Struggle with poor equipment? USE TH BEND



Close tolerances come without a "fight" on a South Bend Lathe. Regardless of the operation you'll find that you can get exact dimensions everytime without slowing up. It's another example of "quality counts." You can always depend on a South Bend to turn out better work. It's built right — it's accurate, versatile and easy to operate. In the long run, it will actually cost you less for you get more and better service. You can't buy a "cheap" machine tool and expect to get satisfactory performance —"cheap" tools are never economical.

**10" X 3', 1" COLLET, BENCH LATHE with metal bench; switch and 3 ph., 60 cy., 220 V., 3/4 h. p. motor; f. o. b. factory. $994.35**
**Time Payments: $249.35 down, $65.80 for 12 months.**

*Other lathes from $160 to $2496, less electrical equipment.*

**SOUTH BEND LATHE**
**SOUTH BEND, INDIANA**
***Building Better Tools Since 1906***

SOUTH BEND

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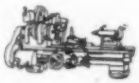
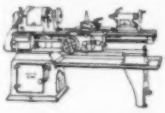
- ☐ LATHE TOOLS AND ATTACHMENTS
- ☐ TIME PAYMENT PLAN

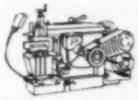


☐ 9" BENCH LATHES



☐ 10" TO 16" FLOOR LATHES

☐ 14" DRILL PRESSES



☐ 7" BENCH SHAPER

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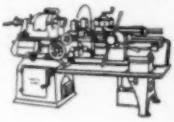
☐ TURRET LATHES ½" and 1" Collets



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**SALES CONTRACTS AND FORMS:** Essentials of a contract; when a sales contract must be in writing; forms of contracts for sale of merchandise; conditional sales contracts; lease agreement; miscellaneous clauses in sales contracts; contracts appointing agents for sale of merchandise; miscellaneous clauses in agency agreements; contracts employing salesmen; special provisions in salesmen's contracts; foreign trade definitions.

**HINTS ON BUYING MERCHANDISE:** Buying the right thing: how to standardize specifications; buying the right amount at the right place, at the right time, at the right price; procedure for handling and analyzing bids; requisitions and purchase orders; receiving and inspecting incoming goods; checking invoices; stores and inventory control.

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**FINANCIAL STA**
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**TYPES OF BUS**
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business.

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nonsense road-map to follow when you
on; planning and maintaining the offices
ney; equipment, files and appliances;
ice procedure function smoothly; econo-
nce and printing of forms; hiring and
ew employees.

**O CHECK CREDITS AND INCREASE
IONS:** Sources of credit information;
adstreet reports; special agency reports;
rchange; salesmen, attorneys and banks
eferences; law relating to checks, notes,
bills of exchange; how to write letters
r refusing credit; how to write col-
tters and reminders; form collection

**O DEAL WITH THOSE WHO OWE
NEY:** Collection of a claim by suit on
obligation; out-of-court agreements; as-
or benefit of creditors; equity receiver-
untary or involuntary petition in bank-
rporate reorganizations; wage earners'

**AL STATEMENTS:** Do you know how
balance sheet? The Handbook tells you
of current assets; fixed assets or fixed
gible fixed assets; investments; deferred
urrent liabilities; fixed liabilities; de-
its; contingent liabilities; reserves; cap-
surplus.

**S INSURANCE:** How to reduce the
ple insurance protection; law governing
olicies; types of policies; fire, burglary,
ry insurance; fidelity and surety bonds;
nance; miscellaneous coverages; business
group insurance.

**RS, OFFICERS, STOCKHOLDERS:**
e to directors; removal of director with
cause; liability of director for acts be-
rate powers; law relating to officers;
an officer for mismanagement; rights,
f stockholders.

**ATE MEETINGS, MINUTES AND
IONS:** Preparations for meetings;
' meetings; directors' meetings and
meetings; how to keep minutes of meet-
mentary procedure.

**SHIPS:** What a partnership agreement
in; division of profits and losses among
ability of a secret partner; power of a
borrow money, collect debts, employ
purchase and sell property; liability of
partner; changing to a corporation,

**F BUSINESS ORGANIZATIONS:**
form of organization for a business;
dditional capital; power to do business
; choosing a name under which to do

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